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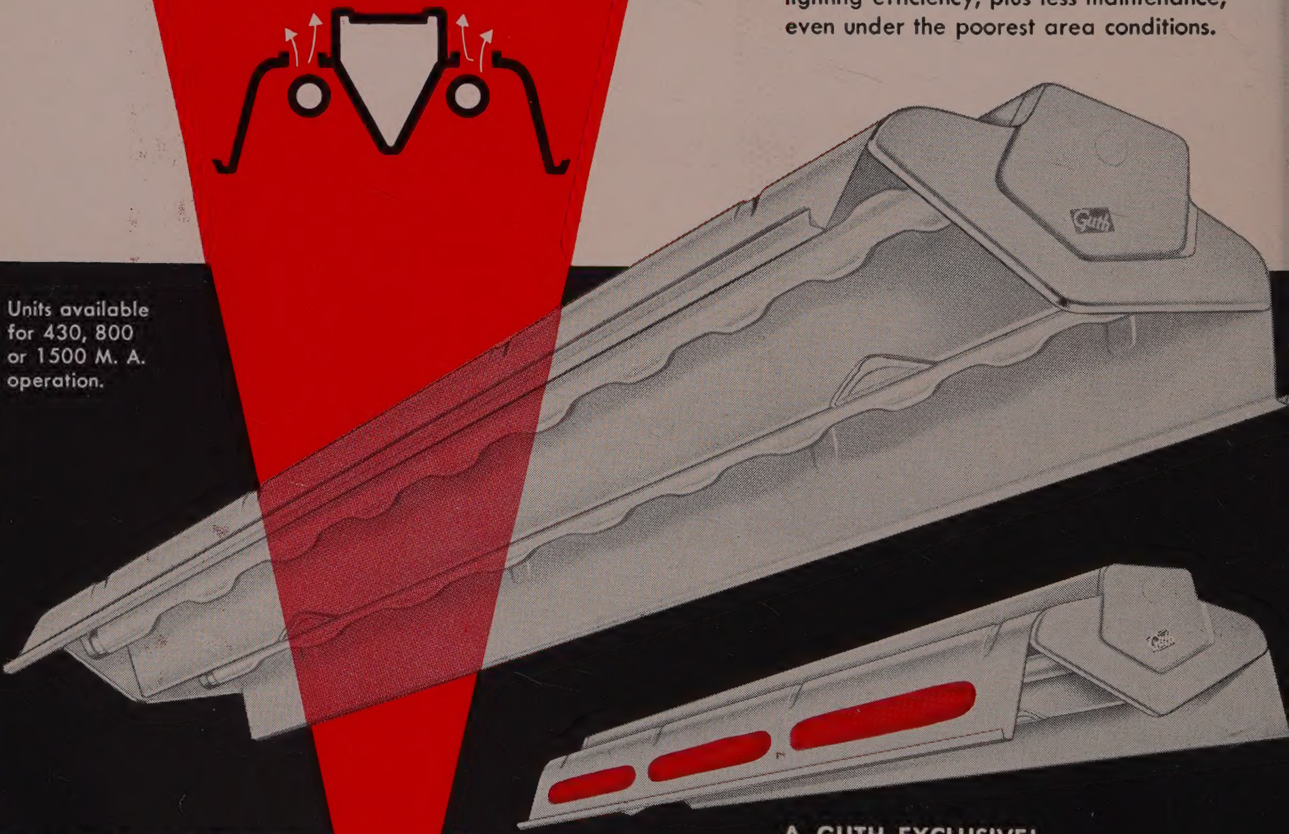

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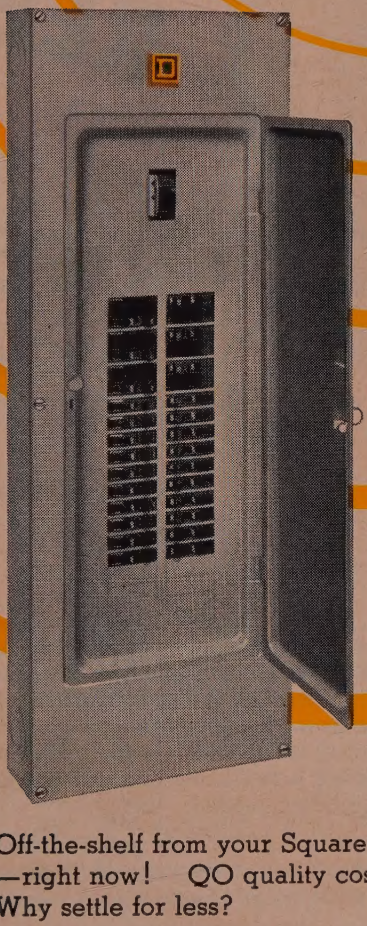

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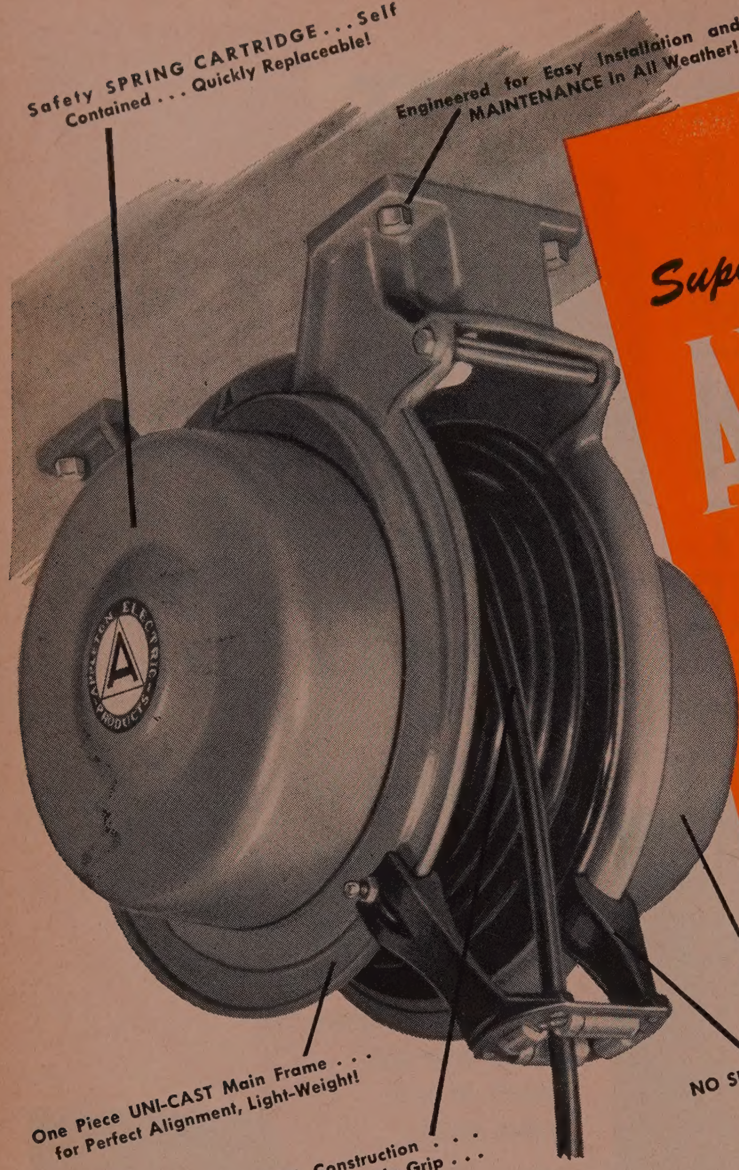
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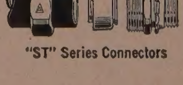
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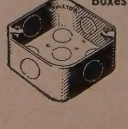
Outlet Boxes

Industrial Lighting

ELECTRICAL CONSTRUCTION AND MAINTENANCE

with which is consolidated Electrical Contracting, The Electragist and Electrical Record   Established 1901

Published for electrical contractors, electrical departments in industry, engineers, consultants, inspectors and motor shops. Covering engineering, installation, repair, maintenance and management in the field of electrical construction and maintenance.

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Illuminated signals and annunciators direct traffic at Denver bank, where bank-by-car facilities include ten drive-up tellers' windows and four incoming traffic lanes.

SILICONE RUBBER News from Dow Corning

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ELECTRICAL CONSTRUCTION AND MAINTENANCE

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Sidelights

NDUCTION/RESISTANCE RATIOS

Choice of low-voltage circuit breakers for safe and efficient operation on circuits with large short-circuit capability can be importantly influenced by the X/R ratio of the protected circuit. Normal circuit-breaker ratings are based upon an X/R ratio of 6.6. Other circuit ratios may require significant departure from nameplate for effective applications. O. V. Albani, engineer, Allis-Chalmers Mfg. Co., describes and charts the critical relationship in an article "Know Circuit X/R Ratio" beginning on page 105.

NECA CONVENTION

The National Electrical Contractors Association conducted its annual convention and trade show in the auditorium at Minneapolis, Minn., the week of October 7. From among the several NECA educational projects discussed, the forthcoming code courses inspired our editorial, "Contractors and the Code" page 73. For photo coverage see page 90. The program report written by Associate Editors J. F. McPartland, August Eckel and Hugh P. Scott and coordinated by Managing Editor Alice McMullen, begins on page 189.

ALLOUT SHELTER

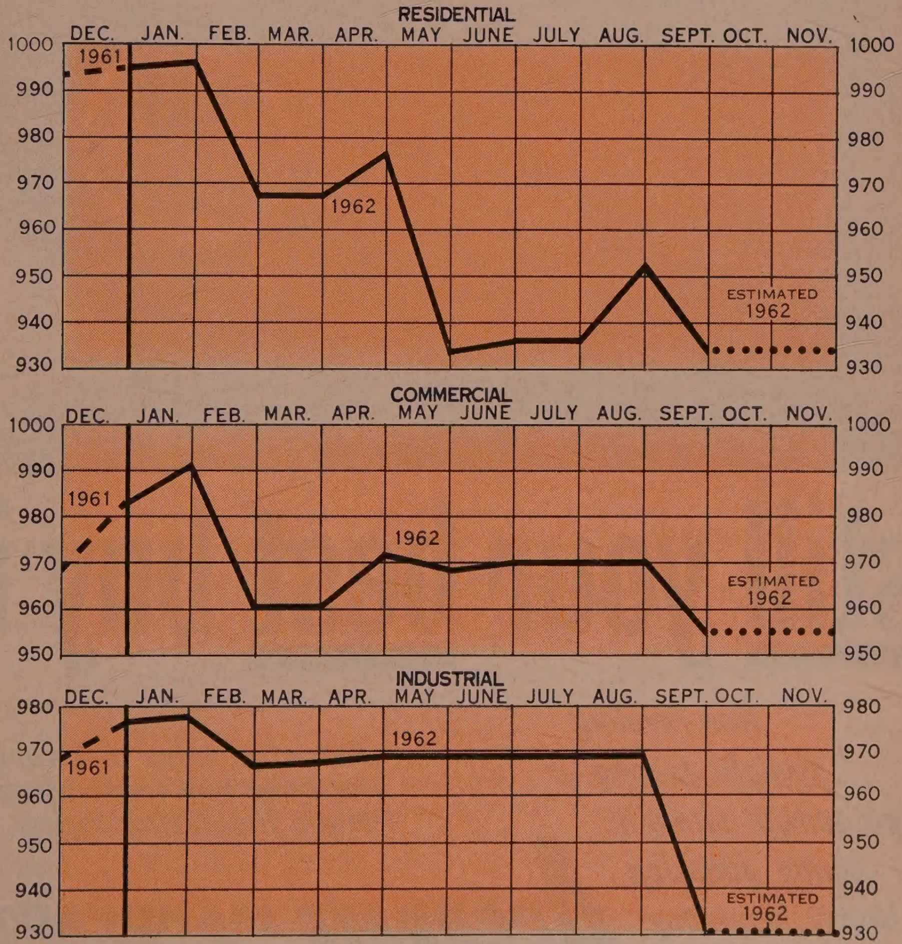
After some ten months of decline in public interest in survival shelters, the Cuban crisis has suddenly precipitated renewed concern. In spite of lagging public interest some projects have gone ahead, particularly in New York State. One of these, a group shelter in Westchester County is designed for fallout protection with self-contained utilities. Assistant Editor Robert J. Lawrie's report, "Prototype Fallout Shelter," begins on page 93.

ELECTRICAL MATERIALS COST INDEX

CHANGES IN THE COST OF ELECTRICAL MATERIALS FOR EACH OF THREE TYPICAL JOBS ARE SHOWN ON THESE THREE CHARTS.

THE BASE (1000) REPRESENTS THE AVERAGE COST OF THE MATERIALS FOR THE YEAR 1960

THE MONTHLY INDEX POINTS SHOW THE VARIATIONS IN COST ON THE FIRST OF EACH MONTH.



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Washington Report

NOVEMBER • 1962

The "cold war" crises of recent weeks could boost the U. S. economy, and maybe delay a recession, according to many of the National Association of Business Economists' forecasters who met in Washington late last month. Some of these economists believe the crisis atmosphere may spur consumer spending, and possibly inventory stockpiling. All agreed that international tensions add a strong new element of uncertainty about the chance for a tax cut next year, which analysts consider as a key to 1963 business trends.

Federal and business economists were all in more or less general agreement, before the Cuban crisis flared up late last month, that there would be a mild decline in business next year, followed by a slow upswing late in the year. Now, the business and economic outlook must be appraised anew in the light of the outcome of the Cuban affair, and of other cold war actions around the world.

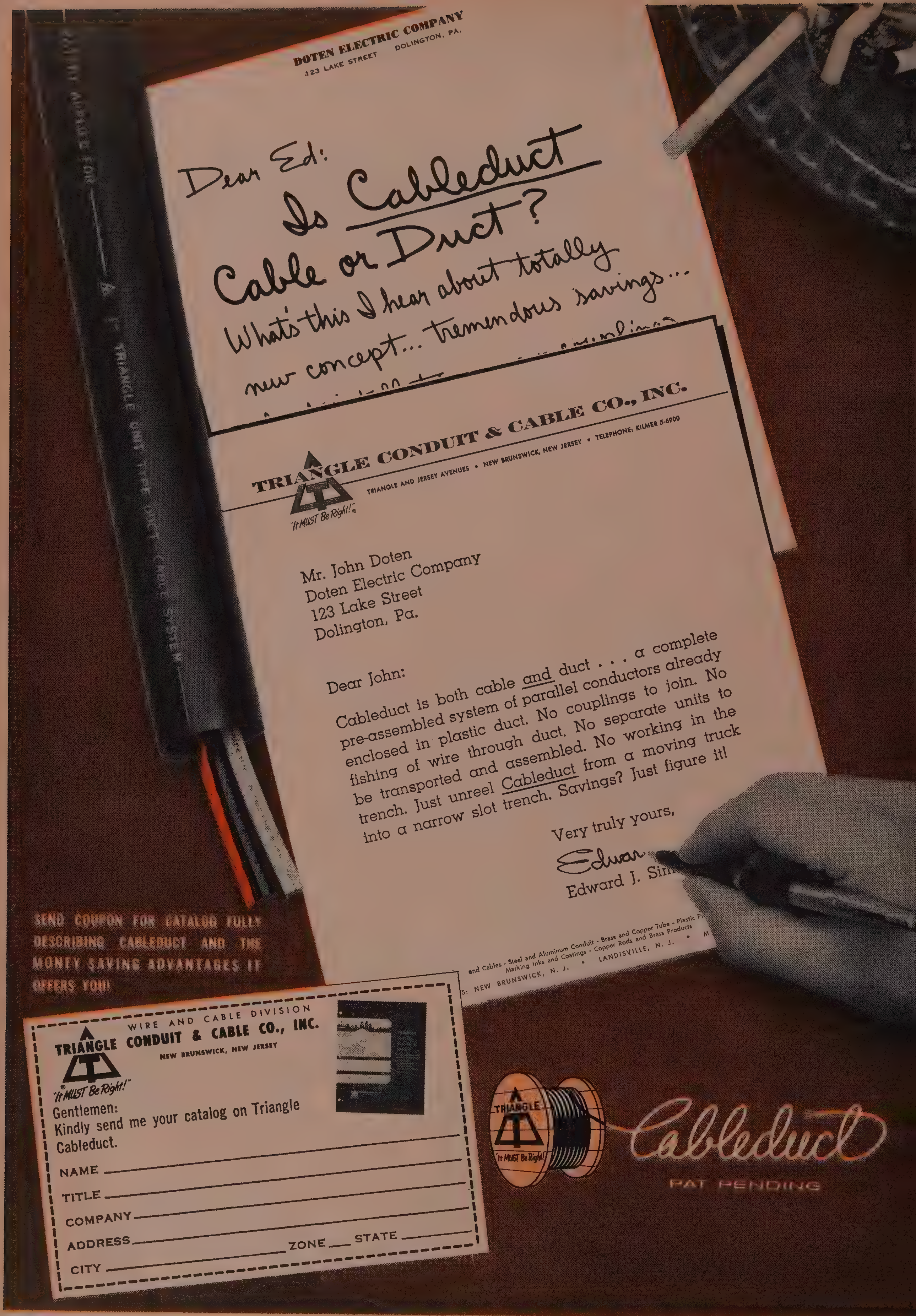
The economy is drifting along at a high level, according to recent statistics, with no boom or severe slump indicated. The 1962 gross national product is now forecast at $554 billion by Dept. of Commerce, which is far short of the Administration's estimate last January of a $567 billion GNP for the year. This new forecast represents a $35 billion increase during 1962 from the 1961 level. Here are some highlights of the most recent statistics:

- **Industrial production** remained constant at an FRB Index of 119% (1957 = 100%) during entire 3rd quarter.
- **Employment** in September was 68.7 million, down 300,000 from August, but up from 67.0 million in September 1961.
- **Unemployment** also declined slightly in September, to 3.5 million, down from 3.9 million in August, but down from 4.1 million a year earlier.
- **Personal income** in September remained at a seasonally-adjusted annual rate of $443 billion, same as for August. A year earlier, personal income was at a $419.7 billion annual rate.
- **Cost-of-living** in September was 106.1% (of 1957-59 average), up from 105.5% in August, and represented the largest monthly increase in four years.
- **Construction spending** in September was at its highest rate on record—a seasonally-adjusted annual rate of $63 billion, up slightly from August.

Construction spending in September totaled $5.9 billion, for a record seasonally-adjusted annual rate of $63 billion. This is 7% above the total for September a year earlier. Private expenditures were $4,075 million, and public expenditures were $1,776 million. Spending on residential buildings increased slightly in September, but outlays for industrial and commercial buildings declined a bit.

Construction contracts next year will increase about 5% over this year's total, according to recent forecast by F. W. Dodge Corp. An increase is predicted in all types of nonresidential building except manufacturing. A small drop in residential building contracts is predicted, with the decline being in apartment construction.

Housing starts in September were 5% below September 1961, and down sharply by 15% from this year's August starts, at seasonally adjusted annual rates. Actual starts in September were 115,600, down 22.3% from August's 148,700 starts, and down 19.3% from last year's September total of 140,200 starts.



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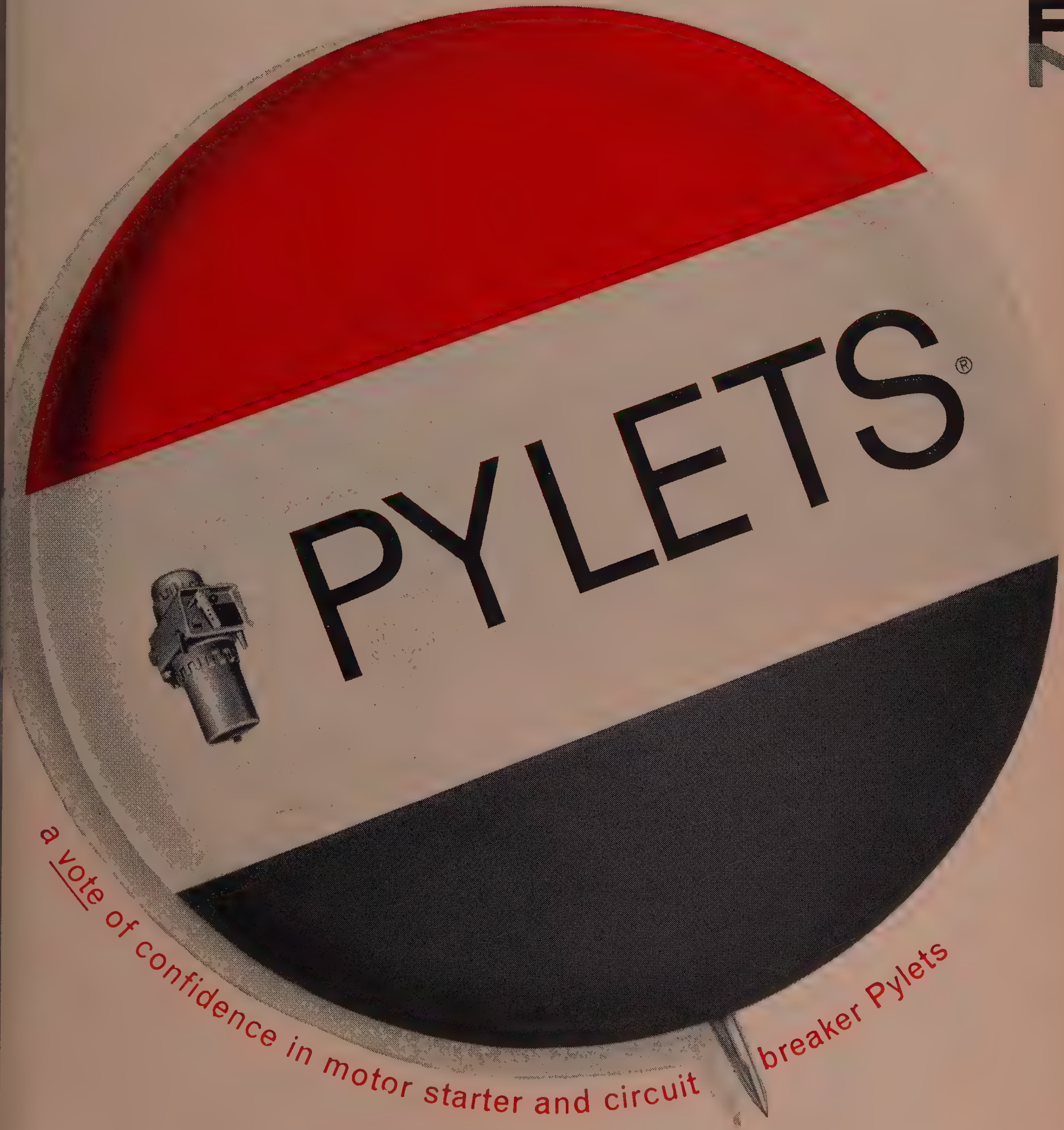
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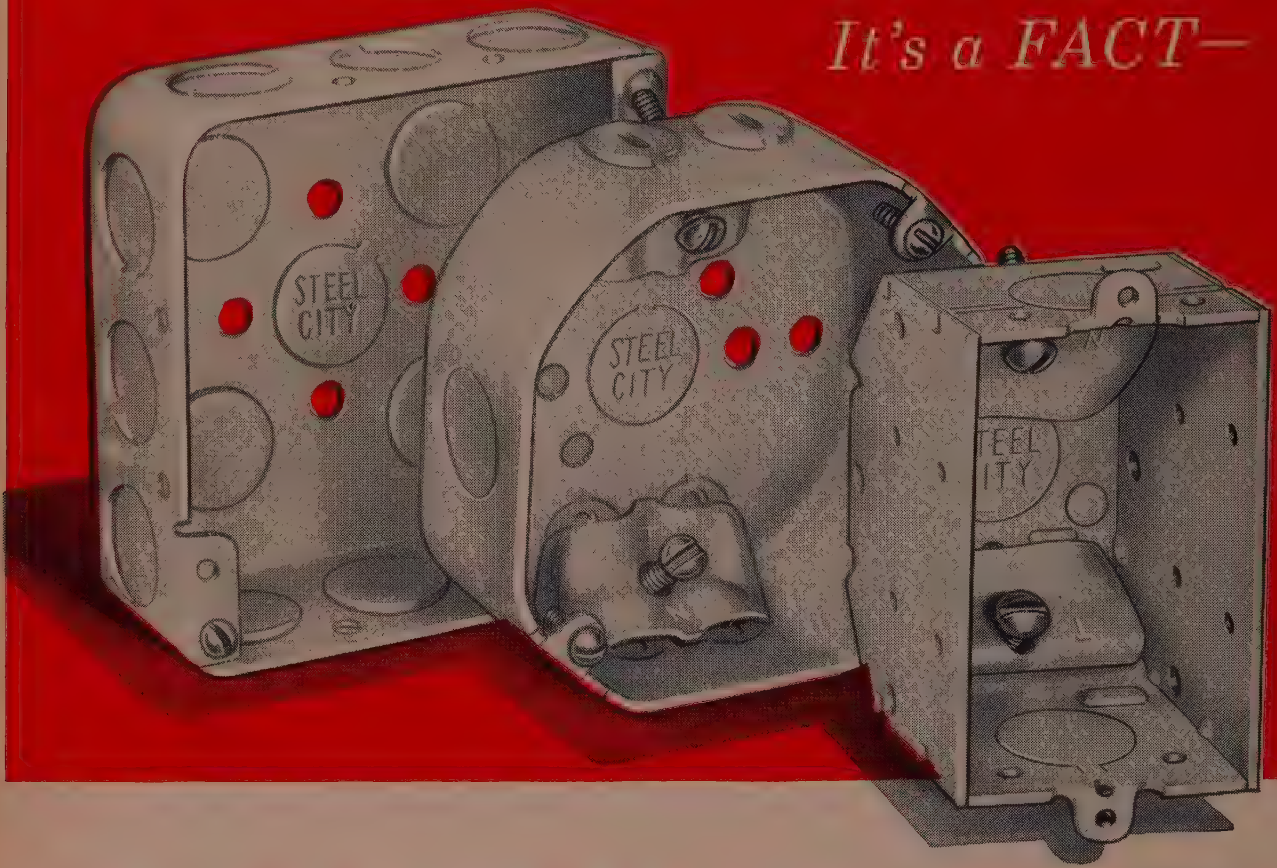

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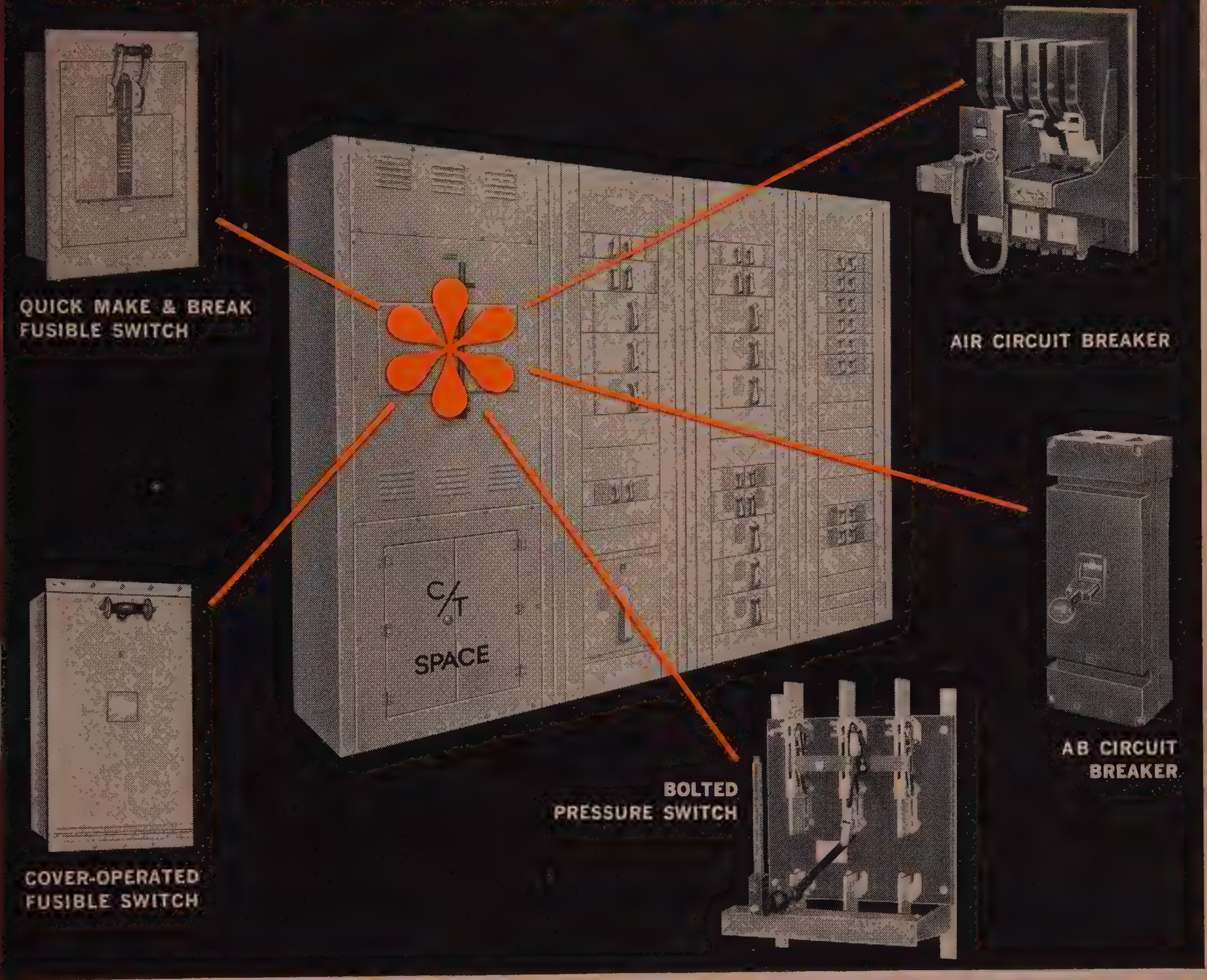

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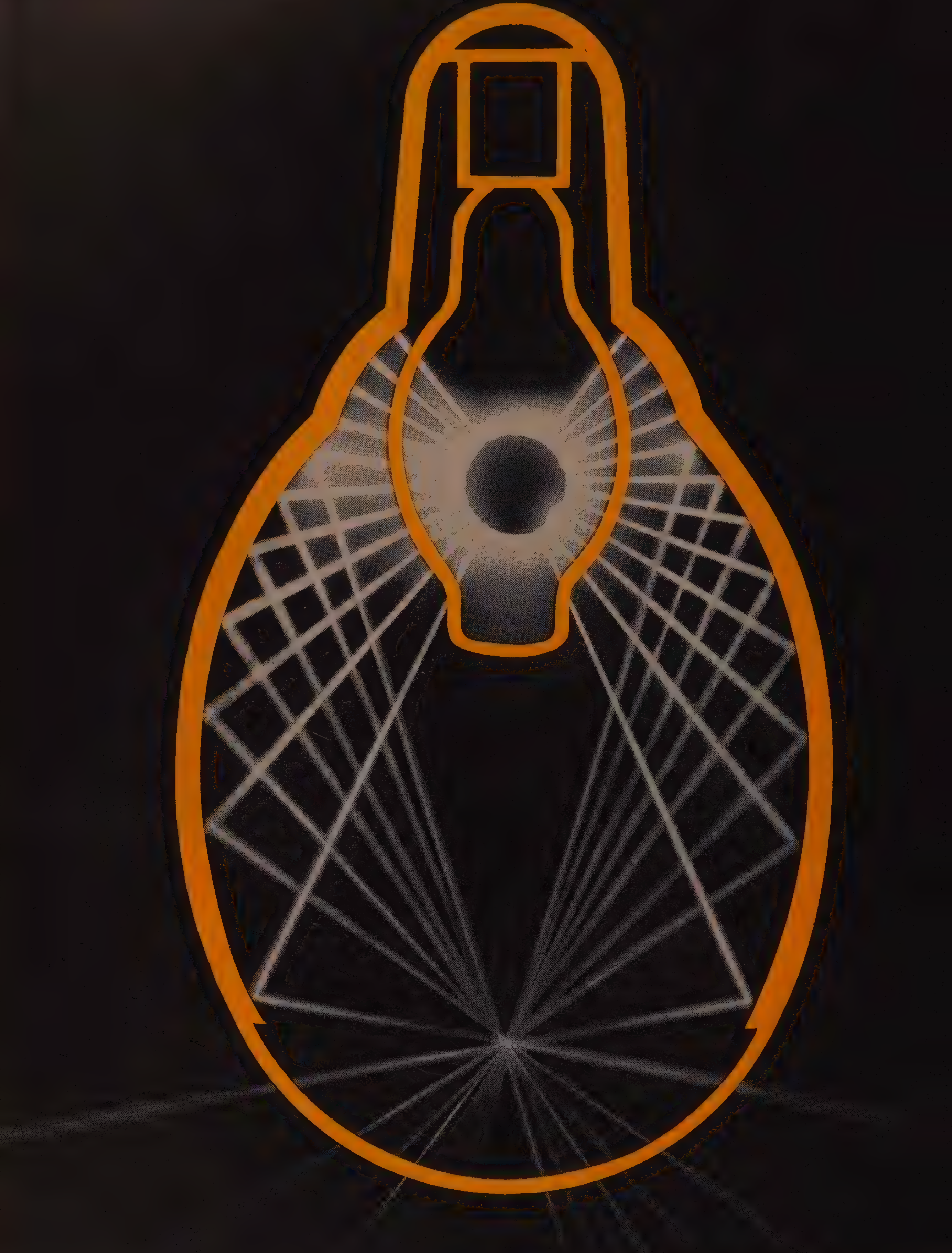


PHOTO-DIAGRAM OF HORIZONTAL CROSS SECTION SHOWS WIDE LATERAL LIGHT DISTRIBUTION

Revolutionary new “Cat’s-Eye” Floodlight* gives widest usable beam

Narrowest floodlight delivers widest horizontal beam plus controlled vertical distribution

The widest usable floodlight beam available today is produced by the narrowest reflector. This seeming paradox of design in Revere’s revolutionary new 400-watt mercury luminaire, the CAT’S-EYE, is explained by the photo-diagram at the left and its adjacent caption. The unit achieves an extremely wide lateral beam spread. A similar demonstration through a vertical cross section would reveal carefully controlled vertical light distribution.

Beam spreads and efficiencies are given in the table below. Notice that efficiency figures are *beam efficiencies* and that changes in the vertical distribution may be achieved without appreciably affecting the wide lateral distribution.

400-Watt Mercury Lamp	Horizontal Beam Spread	Vertical Beam Spread	Beam Efficiency
Clear	158°	39°	57%
Phosphor-Coated	164°	80°	61%

Prior to the invention of the CAT’S-EYE, a light pattern of wide lateral and controlled vertical distribution could be obtained only with a point source in combination with a Fresnel lens. This new Revere floodlight achieves such distribution with high utilization by means of a unique combination of elliptical and parabolic reflector contours.

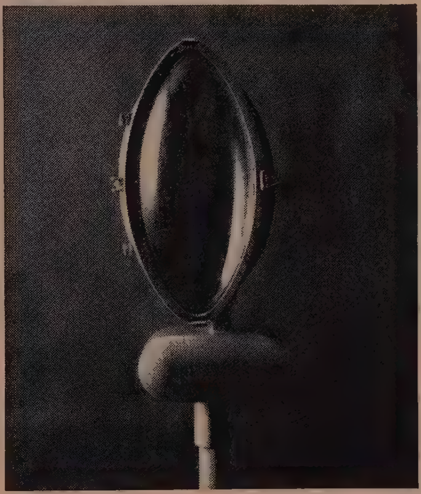
The controlled beam of the CAT’S-EYE puts more light where you want it and makes possible efficient, economical lighting of parking lots, sports areas, loading ramps, and building fronts. Now you can light wide areas with fewer floodlights and attain higher intensities than with conventional units.

We expect that there may be questions about the ability of so narrow a floodlight to produce such a wide beam. To answer these questions our representatives will welcome the opportunity to supply photometric data and to arrange a demonstration that will let this remarkable luminaire speak for itself.

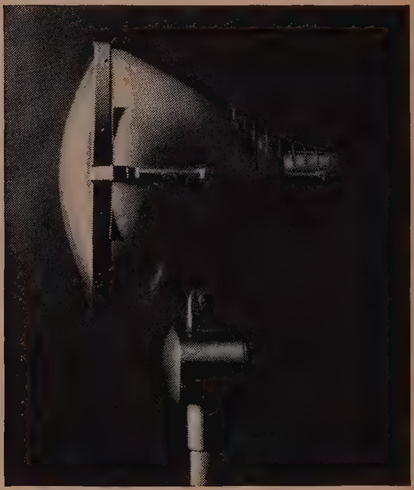
The handsome CAT’S-EYE is internally wired with no cords or wires exposed to view. It is sturdy and weatherproof and is designed for long, trouble-free service and easy installation. A degree-marked fitter and built-in sights assure accurate aiming. The narrow shape permits compact mounting of the floodlights in multiple installations, and accessories are available for pole-top, cross-arm, pipe, or wall mounting.

A combination fitter-housing encloses a choice of constant-wattage or reactor-type ballasts for common primary voltages. A fitter without the housing and integral transformer is used with remote ballasts.

For more information on how you can widen your outdoor lighting horizons with the CAT’S-EYE, send for your copy of Bulletin No. 100-49.



FRONT VIEW *of Revere CAT’S-EYE illustrates slender, upright contour. Unique shape results from use of reflector with elliptical horizontal cross section that produces the widest usable beam of any floodlight.*



SIDE VIEW *shows parabolic contour of luminaire’s vertical cross section which produces controlled vertical beam spread. Combination fitter-housing below the reflector encloses transformer for mercury lamp.*

PHOTO-DIAGRAM *shows wide lateral distribution of light. Line drawing of Revere CAT’S-EYE is superimposed on photograph of reflector’s horizontal cross section. (Note: Special light source is here surrounded by slotted shield to produce ray trace that represents light flux in this laboratory demonstration.) Light control is achieved solely by the compound elliptical reflector. Special heat-resistant convex lens is contoured to prevent internal reflections and to provide maximum light transmission. The lens provides weathertight cover.*

*Patent applied for.

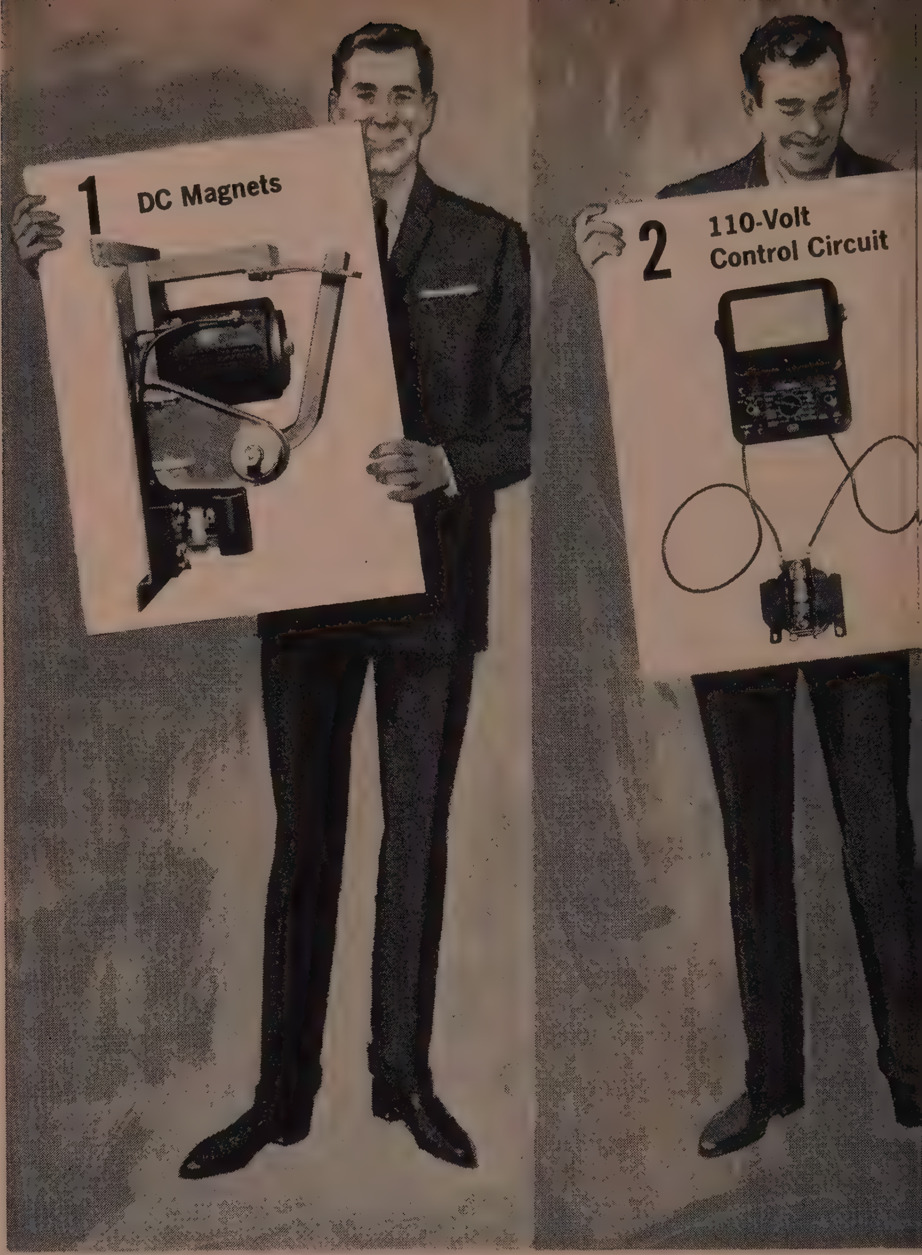
RVR-2-215

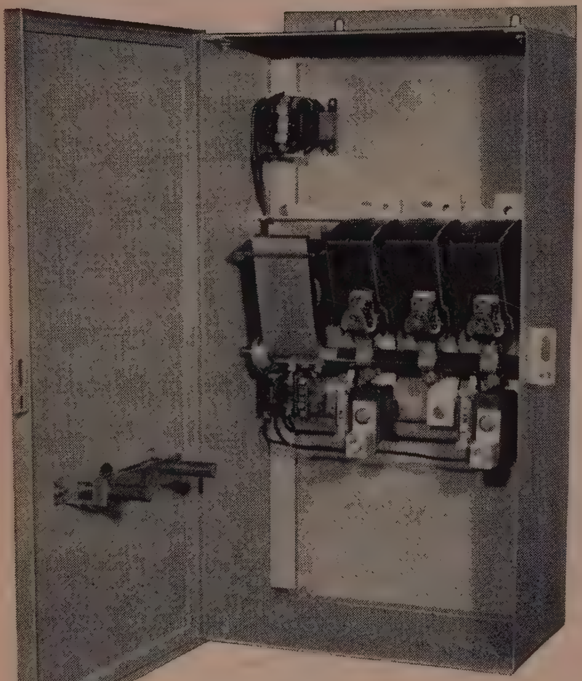
Revere®

OUTDOOR LIGHTING

REVERE ELECTRIC MFG. CO.
7420 Lehigh, Chicago 48 (Niles), Illinois
TELEPHONES: Area Code 312, Niles 7-6060; Chicago, SPring 4-1200. TELEGRAMS: WUX Niles

Five reasons why you'll cut costs with Allis-Chalmers new heavy-duty control





NEXT TIME SOMEBODY TELLS YOU THERE'S NO DIFFERENCE IN LOW VOLTAGE CONTACTORS . . . "TAK FIVE" AND SEE WHAT'S NEW I SIZE 4-9 CONTROL.

Our HEAVY-DUTY size 4-9 starter design will *wo* for you and assure reliability. Time-proved in the mo difficult applications—in highly repetitive installation dirty, abrasive and continuous duty jobs.

Get the combination of design you'll find only Allis-Chalmers new, HEAVY-DUTY size 4-9 contro lers to handle the tough jobs.

This is true HEAVY-DUTY control — *five wa* better for longer life, lower costs.

For example . . .

1. DC Magnets Improve Efficiency

Dc operators are standard on the *entire* line. They a unaffected by dirt and corrosion. They work more quie ly, with minimum wear. Operating burden is lower wi dc. Wide pickup and operating voltage lessens the effe of system disturbances. Low-inertia magnets redu mechanical wear.

. 110-Volt Control Circuit Protects Personnel

ll pushbuttons and other control-circuit components
perate on 110 volts for greater safety. This feature is
tandard throughout the line.

. Self-Cleaning Contacts Assure Positive Conduction

hese mill-type contactors have vertical contact sur-
aces (with "roll-and-wipe" action to limit contactor
ear to non-current-carrying areas) so that dust and
ther particles cannot settle on them. This insures pos-
ive conduction between the closed contacts . . . regard-
ess of the frequency of use. Self-aligning bearings on
ain contact shaft are trouble-free, lubricated for life.

. ACBO Arc Chutes Eliminate Blowout Coils

CBO arc chutes cool and extinguish the arc rapidly
minimize contact erosion and prolong contact life.
nd the arc chutes are easily removed without tools.
ou simply slip them out of place, for easy inspection
f contacts and all other current-carrying components.

5. Front Connections Simplify Installation

All controllers through Size 6 are completely front-connected. So you save time and trouble on wiring. Larger sizes have rear connections to accommodate the larger cable required. Knockouts and terminals are easy to reach and identify.

Allis-Chalmers new HEAVY-DUTY starters and controllers are designed to perform the complete controlling functions for squirrel-cage induction motors . . . and the primary control functions for wound-rotor and synchronous motors. They can also be used to control power for static or resistive loads such as lighting and heating. The line includes full- and reduced-voltage, reversing and non-reversing, multi-speed and combination starters.

• • •

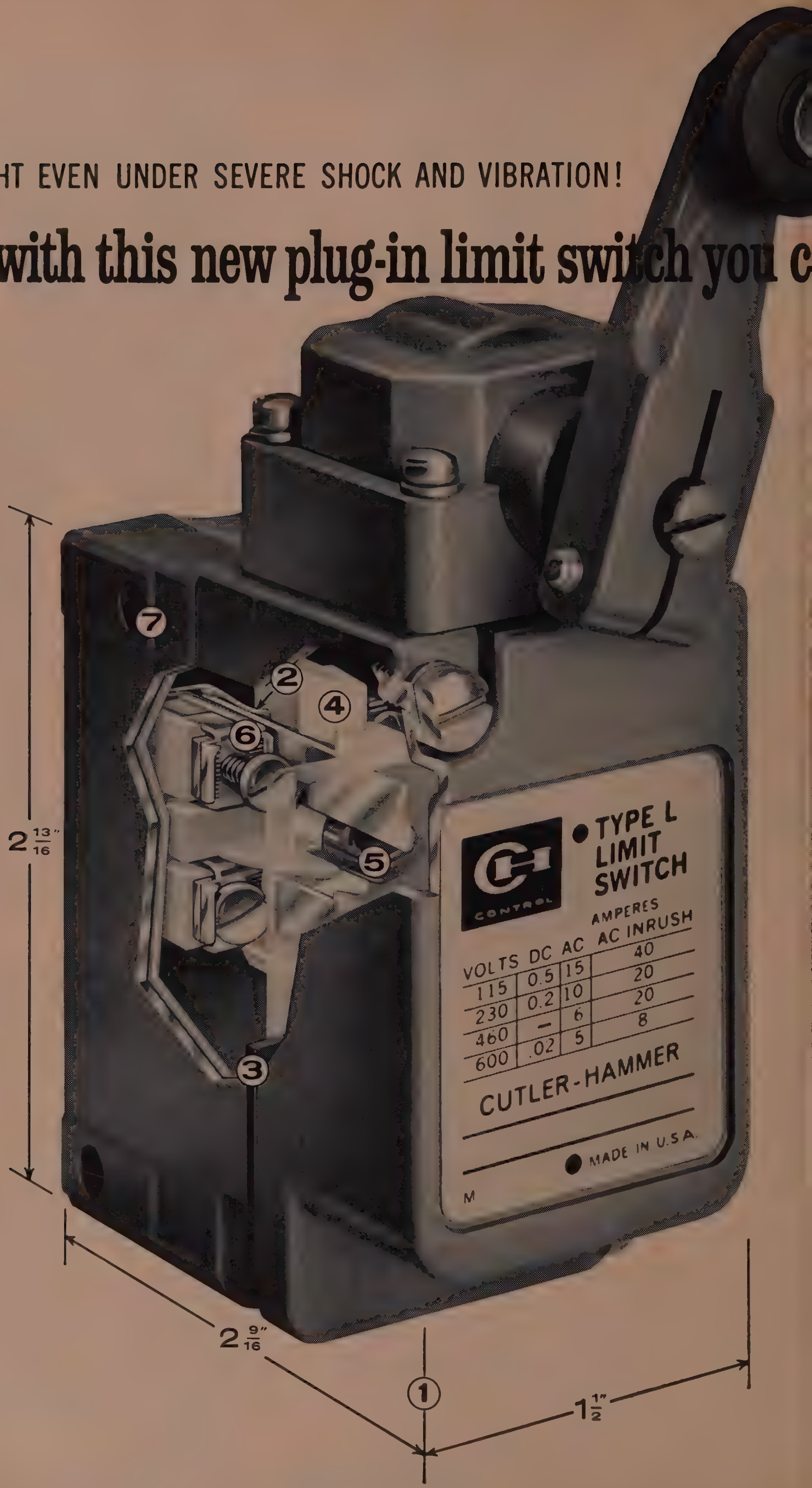
For complete information and application assistance, see your A-C representative. Or write directly to Allis-Chalmers, Box 512, Milwaukee 1, Wisconsin. A-1690

ACBO is an Allis-Chalmers trademark.

ALLIS-CHALMERS

HOLDS TIGHT EVEN UNDER SEVERE SHOCK AND VIBRATION!

Now! with this new plug-in limit switch you c



CONTROL

et a bad connection

ɔu get the benefits of fast lug-in change...all the ɔnnection stability of a andard limit switch...check ıese 7 new Cutler-Hammer atures...compare with any mit switch you've ever seen!

) Smallest mounting area of any plug-in switch.

) Firm grip of generous contact area makes a bad connection impossible. You can actually feel the extra grip when you connect it.

) This is the only switch with oil-tight protective seal between terminal cavity and switch mechanism. No contamination problem.

) Nylon wire spacers hold wiring away from *stabs*.

) Convenient front wiring is easy because terminal blocks remove with one screw.

) Serrated terminals grab straight wire. No looping, no fumbling.

) Plug-in terminal can be mounted either side or back. Great variety of heads and operators gives greater versatility.

hy don't you give your local Cutler-Hammer stributor or sales office a call? They'll have a mple switch for your inspection in a matter hours. Compare it with anything you've er used or are now using. You'll find many ore outstanding features than the seven we've ustrated.

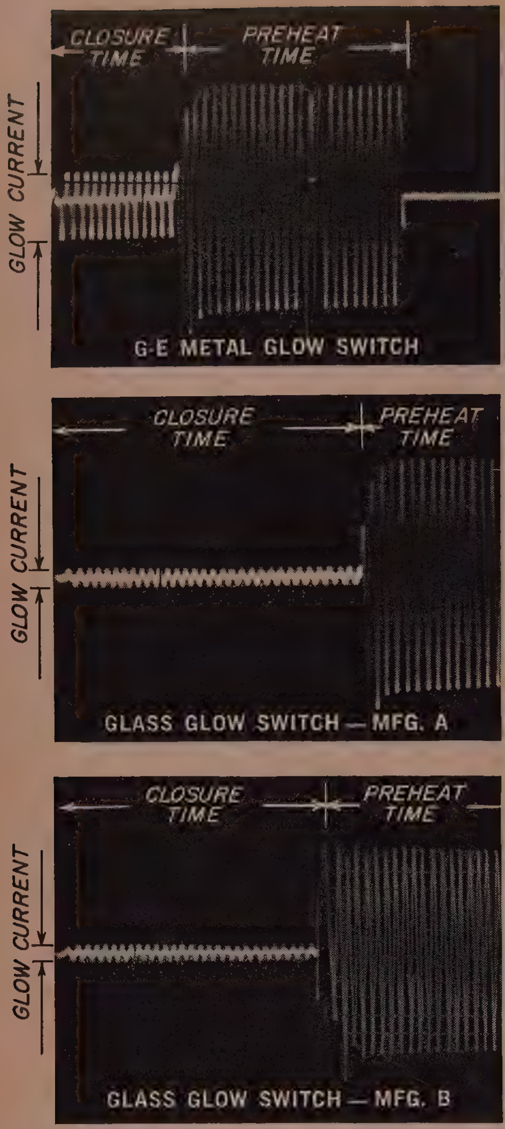
CONTROL

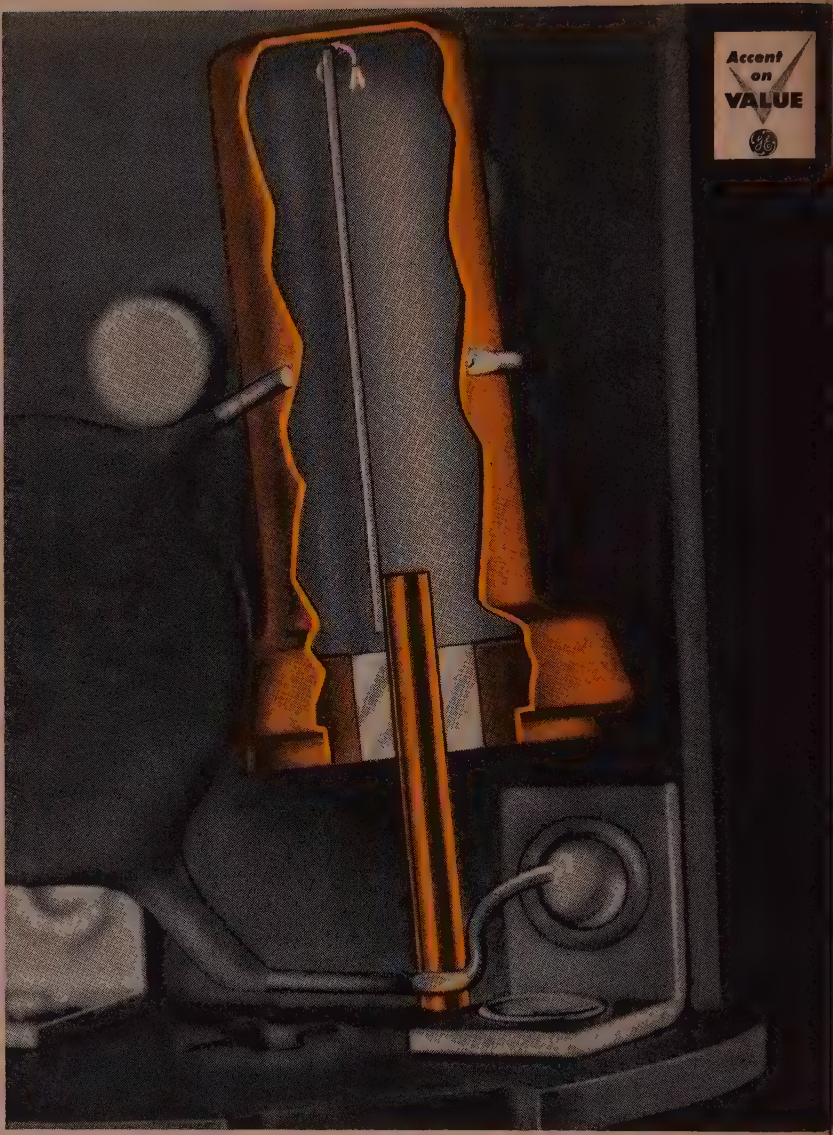
WHAT'S NEW? ASK...

UTLER-HAMMER

LER-HAMMER, INC., MILWAUKEE, WISCONSIN • DIVISIONS: AIL; MULLENBACH
JBSIDIARIES: UNI-BUS, INC.; CUTLER-HAMMER INTERNATIONAL, C.A. • ASSO-
TES: CUTLER-HAMMER, CANADA, LTD.; CUTLER-HAMMER, MEXICANA S.A.

Here are just a few of the many operator options available with new Cutler-Hammer plug-in limit switches. Quality never before available...and versatility to match.





Unretouched oscillograms prove superiority of new G-E metal glow switch in resisting damaging instant starts. Greater glow current prevents switching transient voltages. Shorter closure time cuts down period during which instant starts might occur. New G-E glow switch is much more precise than glass types in other FS-400 starter New design and cool welding proce permit more sensitive bimetal — mo accurate spacings.

New metal glow switch helps G-E FS-400 fluorescen starters resist ruinous instant lamp starts 6 times better than other FS-400 starters!

General Electric development makes group relamping more economical than ever

This unique metal glow switch is now used in all G-E FS-400 Watch Dog* starters. With a precise, small top gap ("A", above) and other new features — it resists instant starting six times as much as glow switches used in other FS-400 starters.

Experience shows that this increases lamp life, since instant starting is the major cause of premature lamp failure.

Offer your customers the many benefits of these new G-E FS-400 Watch Dog starters. They not only save replacement lamps and make grou relamping more economical, but provide thes other advantages, too: reliable starting, eve under difficult conditions — no flickering o blinking of deactivated lamps—longer balla life—up to 10 times longer starter life—elim ination of glow switch breakage.

General Electric Company, Wiring Devic Department, Providence 7, Rhode Island.

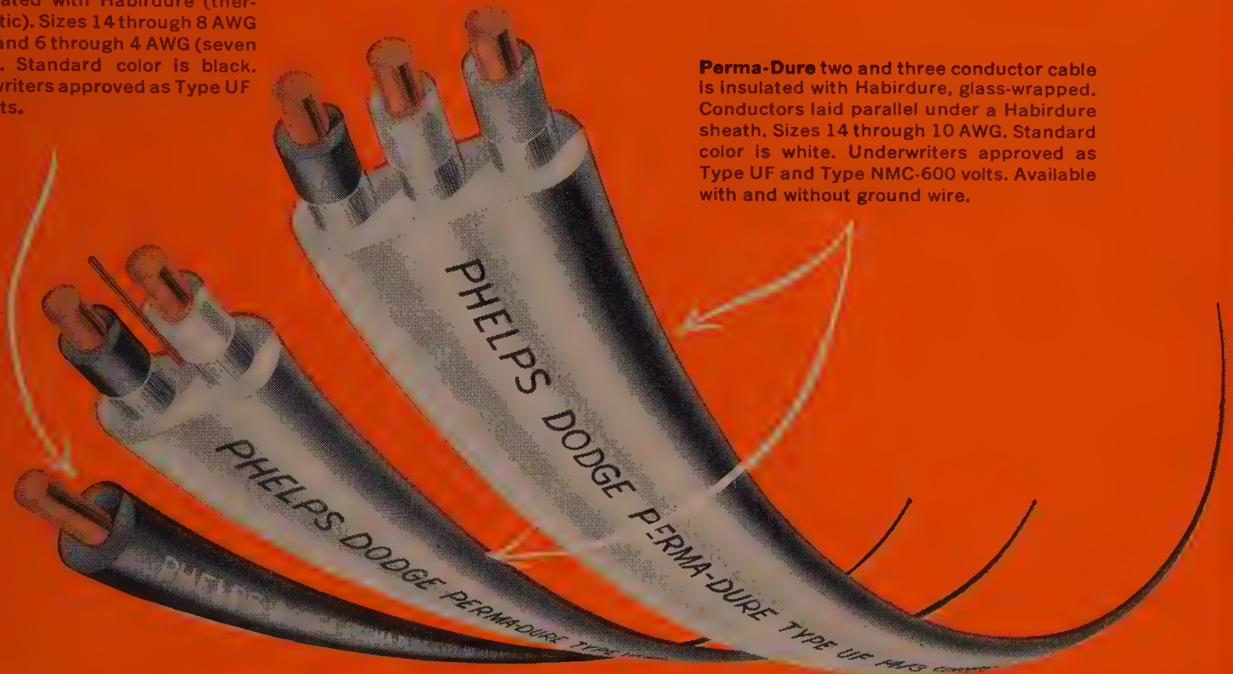
*Registered Trademark of General Electric Company

Progress Is Our Most Important Product

GENERAL ELECTRI

multipurpose

Phelps Dodge Perma-Dure!



Perma-Dure single conductor cable is insulated with Habirdure (thermoplastic). Sizes 14 through 8 AWG (solid) and 6 through 4 AWG (seven strand). Standard color is black. Underwriters approved as Type UF 600 volts.

Perma-Dure two and three conductor cable is insulated with Habirdure, glass-wrapped. Conductors laid parallel under a Habirdure sheath. Sizes 14 through 10 AWG. Standard color is white. Underwriters approved as Type UF and Type NMC-600 volts. Available with and without ground wire.

An Economical, Dependable Cable for

• Underground Wiring Including Direct Burial • Interior Wiring

erma-Dure, a Phelps Dodge product, provides lectrical contractors with a durable, versatile type of flame-resistant cable for industrial and commercial use.

erma-Dure handles easily, strips readily and helps cut installation time and costs. It is supplied in ingle, two and three conductors for feeder or ranch circuits. Under the 1959 National Electrical Code, *Perma-Dure* is recognized as suitable for:

Type UF, single and multiple conductor, as feeder or branch circuit cable, for direct burial in the earth when provided with over-current protection.

Type NMC, multiple conductor (moisture and corrosion resistant non-metallic sheathed cable) for installation in exposed or concealed locations, in dry, damp or corrosive conditions; inside masonry or tile walls; or embedded, when suitably protected, in plaster or shallow chase in masonry.

See Your Phelps Dodge Distributor!

PHELPS DODGE COPPER PRODUCTS
CORPORATION
300 Park Avenue, New York 22, N.Y.

NEW FROM RACO

Oval Service Entrance Cable Connectors. These new pressure-cast oval service cable connectors feature a newly designed shorter throat. The sturdy, non-watertight connector attaches easily to service entrance switch. Clean, smooth threads and burr-free edges eliminate danger of wire snagging and damaged cable. Available in five sizes from ¾" to 2".

Offset Mast Base Reducer. New Raco offset mast base reducer threads directly into meter box. No nipple needed. One piece for easier, faster handling. Offset design makes it perfect for use next to a wall. Available in four popular sizes—2"-1¼", 2"-1½", 2½"-1¼" and 2½"-1½".

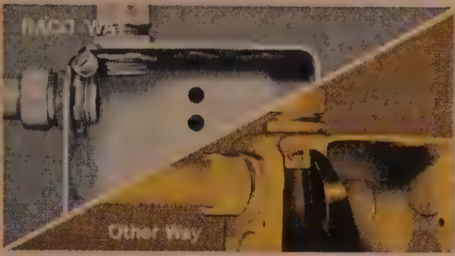
Fittings For Every Need
- Rigid Conduit
- E.M.T. (thinwall conduit)
- Armored bushed cable, flexible metallic tubing and non-metallic cable
- Service entrances

RACO
One-Screw Ears
are Better Than Two

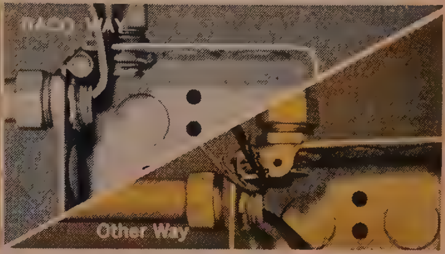
Raco 4" square box with one-screw ear.

One-screw ear gives you flexibility

MORE WORKING ROOM
Raco one-screw ear design boxes give you more working room. Result: More wiring room, all KO's usable, two extra runs per box.

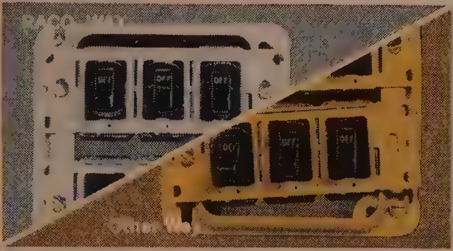


NO EARS TO CLIP
No lost motion clipping ears. No screws to move or lose using Raco one-screw ear boxes.



NO WIRE SKINNING PROBLEMS
With Raco's **one-screw** ear design, wire comes through clean—no skinning. You have more room. Smaller ears don't get in the way.

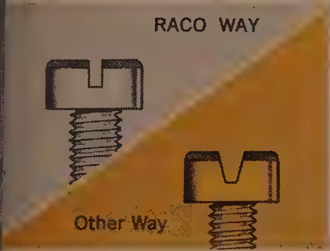
MOUNTS IN ANY POSITION
Whatever position you mount these versatile boxes in, you're always right. You can't install them wrong.



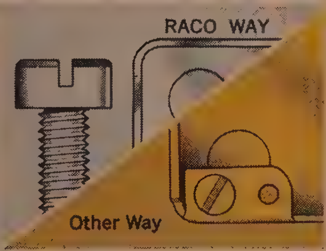
SPECIAL APPLICATIONS
Due to the design of Raco's **one-screw** ear box, you have plenty of room for despard devices or as a transformer housing.

HEAVY DEVICES MAY BE USED
The one-screw ear gives you more working room when installing switches and heavy duty receptacles. Get speedier installation.

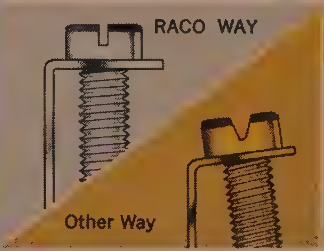
Raco quality saves you money



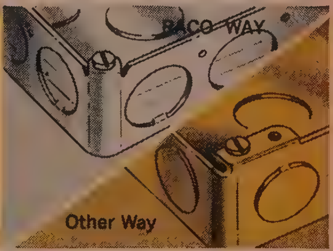
SQUARE SCREW SLOTS. A screw driver won't slip out of the milled slots in Raco screws. No wasted motion—no loss of time.



SCREWS PLATED SEPARATELY. Every screw—and every clamp—is plated before it is put in a Raco box. No rusting. Little details pay off in big savings.

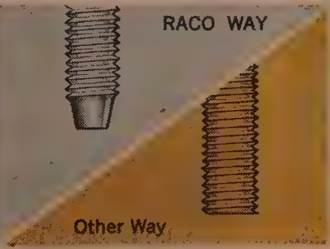


SQUARE EARS. Ears on Raco boxes are always 90° angle. You waste no time "pulling down" ears. Raco boxes are always square, never distorted.

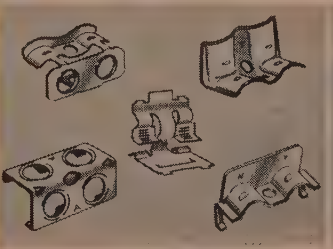


KO TIES AT BOTTOM. You can reach in a Raco box and remove any knockout with ease. Just twist, pull and you're ready to roll. Try it.

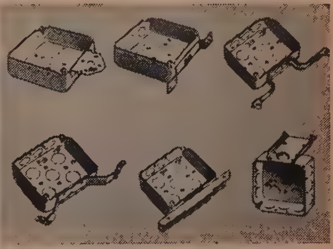
BOTTOM KO's. Clean-cut, Raco bottom KO's are on the inside of the box. It's easier to reach in, than around.



DIE-POINTED SCREWS. Raco's specially designed die-pointed screws go in speedier and easier. The time saved adds up to big dividends for you.



CLAMPS FOR EVERY JOB. There's a Raco one-screw ear box with a metallic or non-metallic cable clamp you need. • Q clamp • X clamp • L clamp • C clamp • N clamp



WIDE RANGE OF MOUNTING BRACKETS. Raco 4" square boxes are available with these brackets. • B bracket • O bracket • F bracket • A bracket • W bracket • J bracket

RACO®

ALL-STEEL EQUIPMENT INC., Aurora, Illinois

NEW GENERAL ELECTRIC "WORK SAVER" PACK

cuts fluorescent lamp replacement time and cost

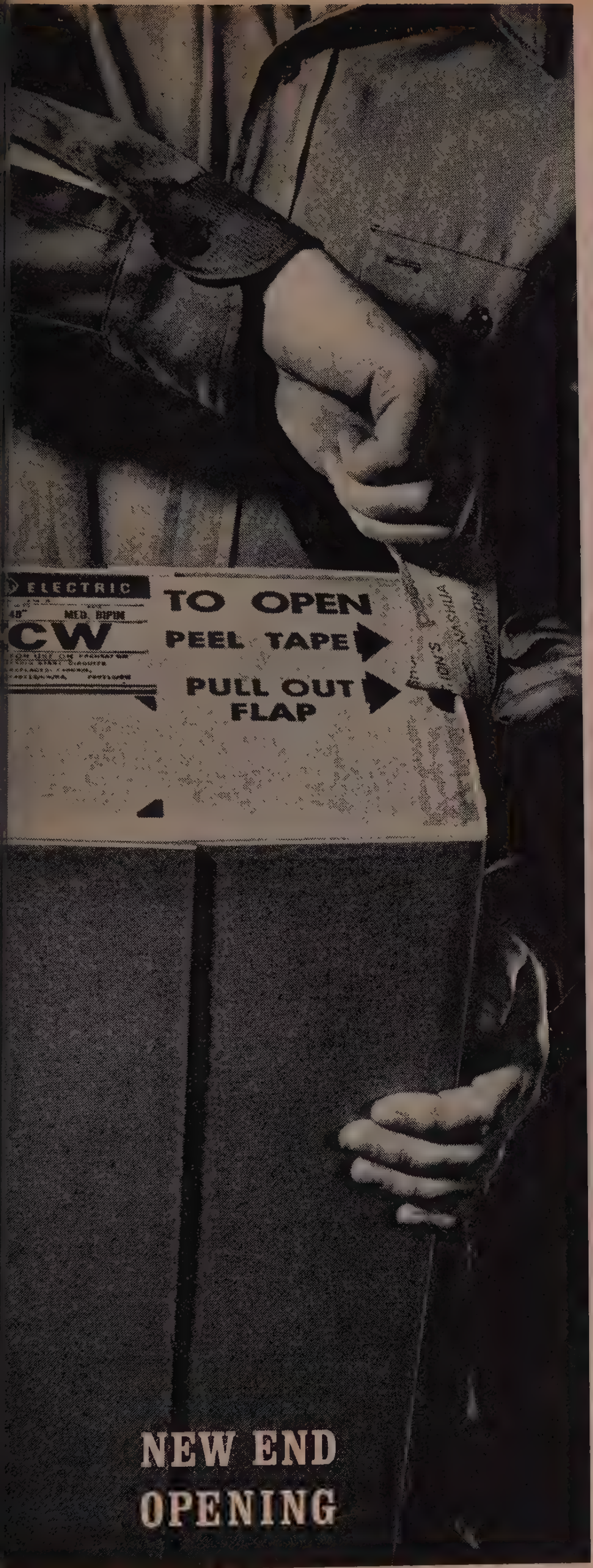
SAVES BOTH TIME AND EFFORT. "Work Saver" value packs are easier for your customer to carry, easier to open, easier to use.

The 40-watt pack holds 24 lamps, weighs only 18.4 pounds—your customer can easily carry two—one in each hand. To make it easy, handholds are cut into the cardboard at key balance points. If more than 24 lamps are needed, it's easy to band packs together.

Opening is zipper-fast—all you do is zip the tape off the end—no prying, no pulling, no tools . . . the end is designed to make reclosing easy. Horizontal opening the whole package is easy, too because of the skip gluin

Your customer saves maintenance trips up and dow the ladder, too . . . a simple wire hook holds the "Wo Saver" pack conveniently on a ladder (these hooks a available from G-E lamp suppliers).

Customers' stocking problems are simplified by the "Wo Saver" pack, too, because 40-watt lamps are oriented s that the identification of lamps are all at the openin end. Even if pack identification is removed, you ca

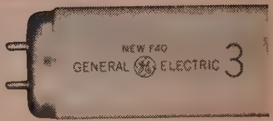


NEW END OPENING

NEW HOOK-ON CONVENIENCE

quickly see what type and wattage lamps you have—no more pulling out a lamp all the way to learn the type. "Work Saver" packs are the same size as previous G-E packs—can be stored in the same space as before.

"Work Saver" packs are now available to your customer in F40 and other commonly used 40-watt fluorescent types —they are standard, no special ordering required. Both you and your customer can share in the profits if you tell this new packaging story. To find out more, call your General Electric office or write General Electric, Large Lamp Department C-260, Nela Park, Cleveland 12, Ohio.



EXTRA LIGHT FROM THE MOST VALUED FLUORESCENT—the new G-E F40 already brings you more light than any other cool-white 40-watt fluorescent—now you can utilize this extra lighting value more easily in the "Work Saver" pack.

Progress Is Our Most Important Product

GENERAL ELECTRIC

and
the United Engineering Center in New York and
the Philharmonic Hall in New York's Lincoln Center and
the Humble Oil Building in Houston and
the Tishman Office Building in Buffalo and
the Bethlehem Steel Office Building in Buffalo and
the Children's Hospital in Pittsburgh and
the RCA Building in Cannonsburg and
the McDonnell Aircraft Building in St. Louis and
the North American Aviation Building in Los Angeles and
the State Office Building in San Francisco and
the Stanford University Hospital & Medical Center in Palo Alto and
the Hilton Hotel in San Francisco and
the Ilikai Apartments in Honolulu and
the Pacific Power and Light Building in Portland and
37 buildings at "Century 21," the Seattle World's Fair!

View from the 45th floor of the new Pan Am building, looking north toward the Union Carbide build
There is more than a mile of Federal Pacific riser bus duct in each of these New York City skyscrap

trical power in these modern structures is distributed and controlled by Federal Pacific
pment. Substations and switchboards...control centers...panelboards...riser bus
...the industry's latest and most advanced designs for the nation's newest build-
. You're sure to be in good company when you specify and use FPE equipment, too!

AL PACIFIC ELECTRIC CO., 50 PARIS ST., NEWARK 1, N. J.

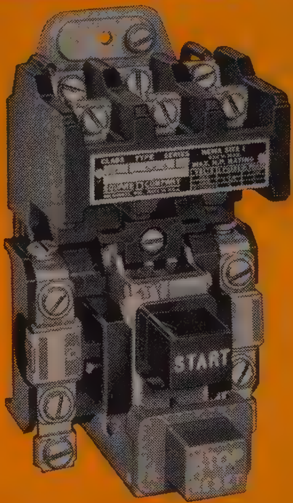
FPE FEDERAL PACIFIC
growth through creative energy

This Manual Starter has *EVERYTHING!*

NEMA Sizes 0 and 1

Two, three and four-pole construction

- **SMALLER!** Takes less space, whether it's built into machine or mounted externally
- **SMART STYLING!** Matches the streamlined appearance of modern machines
- **QWIK-MAKE, QWIK-BREAK!** Positive snap-action opening and closing of contacts. Longer contact life
- **TRIP-FREE OVERLOAD PROTECTION!** Impossible for operator to hold motor circuit closed against overload
- **POSITIVE PROTECTION!** Starter will not operate without overload units installed
- **LONGER LIFE!** *Toggle-Action* operating mechanism. Heavy-duty construction throughout
- **EASIER INSTALLATION!** Wire it without removing starter from enclosure. All terminals have pressure wire connecto
- **EASIER MAINTENANCE!** "Off-the-Shelf" part kits make normal maintenance easier than ever. They're easy to buy, easy to identify, and faster to install
- **TAMPER-PROOF!** Cover padlocking device prevents tampering by unauthorized personnel. Safety latch locks "start" butto in "OFF" position
- **VISIBLE INDICATION OF OVERLOAD!** Self-centering push buttons show when overload has occurred



CHOICE OF ENCLOSURES:

- General Purpose
- Water and Dust-tight
- Hazardous Locations
- Flush Mounting

write for complete details on Class 2510 manual starters. Square D Company, Dept. SA, 4041 N. Richards Street, Milwaukee 12, Wisconsin

SQUARE D COMPANY

wherever electricity is distributed and controlled

WIREMOLD®
ELECTRIC IDEAS

PREPARED EACH MONTH FOR ELECTRICAL CONSTRUCTION AND MAINTENANCE TO BRING IDEAS, NEWS AND HELPFUL INFORMATION TO ELECTRICAL MEN

63rd YEAR

NOVEMBER 1962

IOTEL REWIRING .... FIRST PAGE
ODE COMMENTS .... FIRST PAGE
UIZ CORNER .... SECOND PAGE
RODUCT OF THE MONTH .... SECOND PAGE
NOTEWORTHY .... SECOND PAGE
COUPON FOR FREE ITEMS .... SECOND PAGE
ENGINEERED SPECIALS .... FOURTH PAGE
USEFUL LITERATURE .... FOURTH PAGE
WORTH READING .... FOURTH PAGE
PRACTICAL TIPS .... FOURTH PAGE

Hotel Rewiring Project Features Surface System

Complete modernization program brings awards; attracts favorable comments

Electrical convenience and a comfortable bed are standards of a fine hotel.

Just how important wiring is to a hotel is shown by the rewiring of the 1000 guest rooms of the Pick-Congress Hotel in Chicago, as part of a multi-million dollar renovating program.

Rewiring was planned by Ray B. Hambel, chief engineer of the hotel, a man with long years of experience in hotel engineering. For the job, Mr. Hambel specified Plugmold 20GA30, one of the multi-outlet systems manufactured by The Wiremold Company.

continued on third page

PLEASANT ROOM in Pick-Congress Hotel, Chicago, features multi-outlets around the walls. Rewiring was an integral part of the award winning renovation of the 1000-room hotel.

Code Comments

Free Conductor Length

Q. *What free length of conductors shall be provided at outlets?*

A. According to Article 300, Section 300-14 (Free Length of Conductors at Outlets and Switch Points): "At least six inches of free conductor shall be left at each outlet and switch point for the making up of joints or the connection of fixtures or devices, except where conductors are intended to loop without joints through lampholders, receptacles and similar devices."

Increased Circuit Capacity

Q. *For increased circuit capacity, may parallel runs of Wiremold be installed?*

A. Yes. Article 300, Section 300-20 (Induced Currents in Metal Enclosures) permits this. ". . . When the capacity of a circuit is such that it is impracticable to run all conductors in one enclosure, the circuit may be divided and two or more enclosures may be used provided each phase conductor of the circuit and the neutral conductor, where one is used, are installed in each enclosure . . ."

Fire Alarm Systems

Q. *Can fire alarm and exit lighting systems be in the same raceway?*

A. No. See Article 700-17 and Article 800-3 (para. a2) (National Electrical Code).

WIREMOLD®

Advertisement

Quiz Corner

Questions for this department are taken from inquiries received from the field. Your questions are welcome; indeed, they are necessary if this department is to serve you with worthwhile information. Address:

Quiz Corner
The Wiremold Company
Hartford 10, Conn.

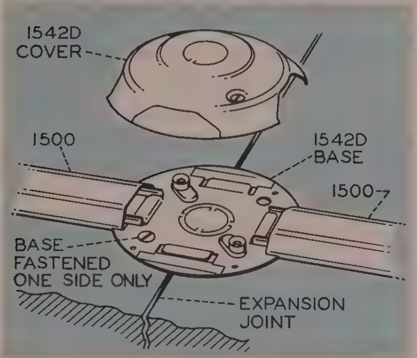
Q. *Is there an end entrance fitting for Plugmold 2000 which will accept a 1/2″ connector in the back side?*

A. 1/2″ KO's in base of 2000 permit this type installation.

Q. *Is there an interconnecting fitting to connect Pancake 1500 (on floor) to 2000 (running down wall)?*

A. No. However, by using two fittings, 1517A and 2089E, this can be accomplished.

Q. *How do I cross an expansion joint in the floor with Pancake 1500?*



A. One method of crossing an expansion joint with Pancake® 1500 is to use a 1528 utility box or 1542D junction box. To install, position base directly over joint and fasten to floor on one side of joint only. Slide Pancake 1500 on tongues. To insure continuity, a jumper can be installed between bases. The cover is then fastened to the base.

Q. *What is the best way to cut Wiremold?*

A. Use Wiremold 40-tooth hacksaw blade. See Practical Tips, fourth page.

Q. *Can 2100 cover be ordered unscored and, if so, is there an extra charge?*

A. As stated on page 11 of Catalog and Wiring Guide No. 22, 2100 cover can be furnished unscored on special order at no additional cost.

WIREMOLD®

Product of the Mont

Fitting redesigned for installation ec

Redesigned to eliminate the need to cut the raceway cover back by ⅝-in., the 2010A Entrance End Fitting simplifies joining Plugmold 2000 with ½-in. conduit and armored cable connectors.

The redesigned fitting measures 2⅛-in. long by 1¼-in. high and extends 1⅜-in. above the raceway.

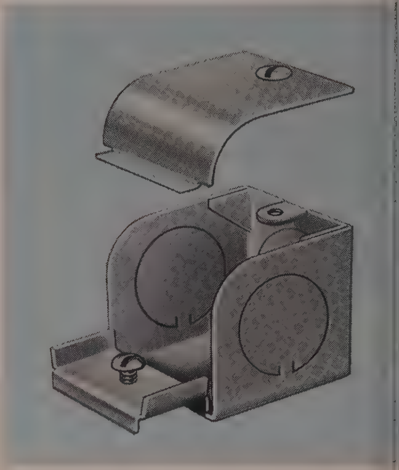
The 2010A is attached by slipping the base of the fitting into the base of the raceway and fastening with the screw provided. The conductors are brought through any of the three twistouts in the usual manner.

The cover of the fitting is attached by placing it in the proper position and tightening a second screw into the flange in the base. The raceway cover is then snapped into place.

Like all Wiremold fittings, the 2010A has adequate splicing room to facilitate making difficult connections.

The fitting is made of .040-
steel and is available in the Wi
mold buff or gray finish.

The 2010A is one of a compl
line of standard Wiremold fittin
available from your electri
distributor.

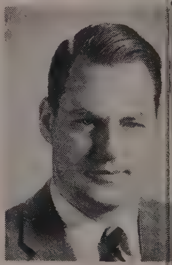


Noteworthy

Personnel at Meeting

Ambrose J. Massey, Chicago, a
Sam Page, Home Office, repres
Wiremold at American Vocatio
Association Convention, Milwau
Auditorium, Milwaukee; Dec. 4

Ambrose Massey



Sam Page

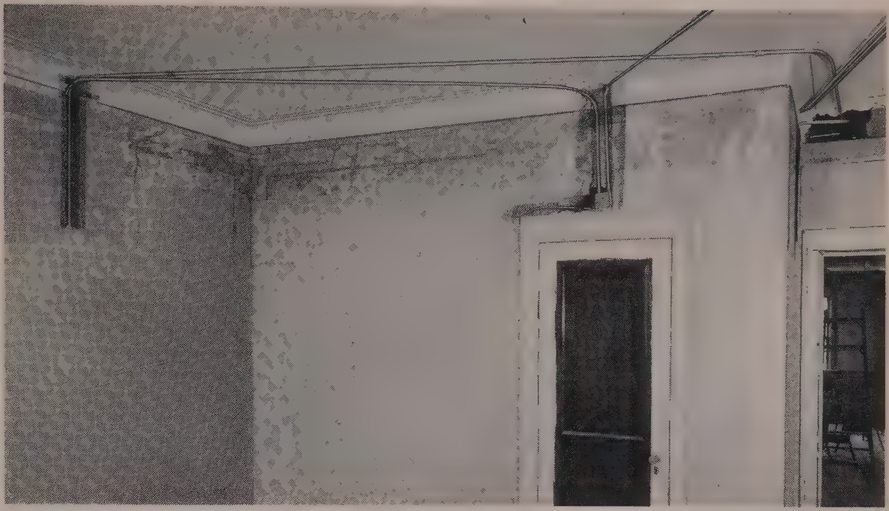
WIREMOLD ■ HARTFORD 10, CONN. E2-11
Gentlemen: Please send free the checked items

NAME
COMPANY
ADDRESS

☐ Chicago Electrical News reprint
☐ Circuit Breaker Housing Bulletin
☐ Electric Ideas, October, 1962
☐ Electric Ideas, September, 1962
☐ Wiring Guide (Catalog 22)

otel Rewiring Project *continued from first page*

EFURBISHED HALLS have new look. Conuit is concealed above dropped ceiling.



PROGRESS PHOTO shows room before new ceiling covered conduit. Old room wiring, which provided only three outlets, was discontinued, together with overhead lighting.

“There's one nice thing about 'lugmold — it saves money,” says Ir. Hambel. He estimated that reviring costs were cut 50 percent vith Plugmold®.

“And Plugmold means future perational savings. Unless gas ighting comes in, the hotel's wiring s set for the next 65 years,” he ontinued.

The speed and ease of installation f Plugmold minimized the downime of hotel facilities. With conealed wiring it would have been ecessary to close down large segnents of the hotel.

Plugmold is also a boon to future naintenance work. Because it is nounted on the surface, time will ot be spent hunting for broken eeds, etc.

Electrical contractors Hohman & Hill, Inc., first brought in a new service of 8000 amps into the two-building complex, divided equally for general and mechanical service. Four 3-in. risers extend from the panel board in the basement of each of the two buildings to distribution panels on each floor.

Except for a few added outlets, corridor wiring was left intact but the old room wiring was discontinued. In its place conduit was run across the ceiling and channeled down the wall to the Plugmold, which is mounted above the baseboard. Rooms and halls now have dropped ceilings. The new conduit was run across the the old ceiling.

The rooms have a perimeter layout of Plugmold. In rooms with bay windows, electricians mitered the Plugmold to the jogs in the bay using a Wiremold cutting box.

Time-consuming individual splices were avoided with the use of 500-foot reels of Snapicoil® 20GA30R — a factory-wired harness with outlets spaced to match openings in the cover sections.

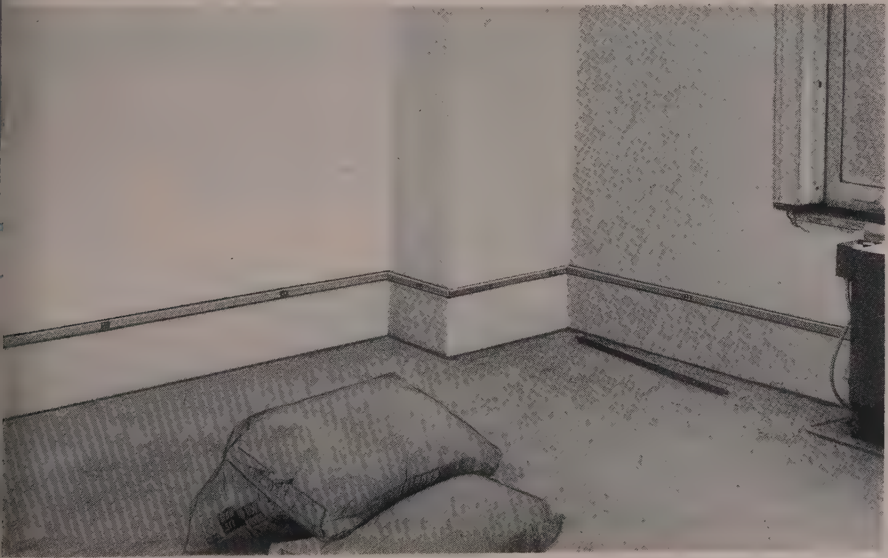
Each room has two 20-amp circuits, one constant and the other switch-controlled. Outlets are alternately-wired every 30-in. The constant circuit handles the air conditioner, TV, bed lamps and half of the room outlets. Switches control the remainder of the room outlets, the bathroom lights and the dressing table and reading lamps.

Adjacent to the entry is a lighted switch, making it easy for the guest to turn a light on as he comes into the room.

Overhead lights with their service problems and obsolescence were eliminated.

The hotel staff has expressed its approval of the new system because of the built-in flexibility for furniture arrangement. This feature fits in with the hotel's policy of periodically refurnishing rooms.

Decorators can now arrange furniture without worrying if a piece is going to block a needed outlet — lamps are never more than a cord's length away from an outlet.



ERIMETER RUN of Plugmold is mounted above baseboard with alternately wired outlets every 30 inches. Rooms have two 20-amp circuits, one constant and one switched.

WIREMOLD®

Engineered Specials

Special strip for Univac III Computer Syste

PROBLEM:

To provide an individual circuit for each section of the Univac III Computer System, manufactured by the Univac Division of The Sperry Rand Corporation, which would allow work to be done on one section of the computer without shutting down the others.

SOLUTION:

A special strip ED-40197B, was designed to supply each module with power outlets, with a feed going back to the power source. The finish of the cover is textured to match the computer's surface.

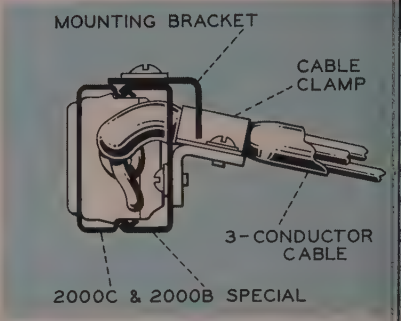
DISCUSSION:

The ED-40197B, a modification of Plugmold 2000, assures continuous operation of the Univac III while individual sections are being serviced.

The special 2000 base is fitt
with a cable mounting bracket a
mounting bracket for attachme
to the computer. There are t
grounding type outlets in the cov
spaced 22-in. apart.

When installed, the unit is
conspicuous because of its size a
matching color.

The special mountings and su
port fittings were fabricated and
sembled by The Wiremold Compa



Useful Literature

Check coupon on second page
for copies of listed items.

Circuit Breaker Housing

New 2-page bulletin gives complete information on the 3046KD and the new 3046KT-type circuit breaker housings.

The 3046KD is designed for use with single-pole and 2-pole cbs. And the 3046KT-type is intended for up to 3-pole circuit breakers.

The illustrated bulletin gives details on mounting, descriptions of the housings, and indicates application advantages.

Worth Reading

Check coupon on second page
for copies of listed items.

Home Buyers Prefer Multi-Outlet Wiring, Chicago Electrical News, July 1962. An electrical contractor reports how a home builder gained an edge over his competitors in a Chicago suburb by installing surface raceway in his split-level models.

Practical Tip

Wiremold hacksaw blade saves time cutting racew

The shatterproof, high-speed steel 614A Hacksaw Blade is designed specifically for cutting all Wiremold raceways quickly and smoothly.

In cutting across metal raceways, the 40-tooth blade doesn't jump because there are always at least two teeth bearing on the surface.

To make a cut, mark the line where the cut is to be made. Place the raceway on a flat surface and apply the blade at the cutting line. Use thumb to steady blade until the surface is penetrated. Cutting on the backstroke prevents kinking and the finer tooth blade makes it easier to follow the mark.

One and two-piece raceway should be cut as a unit for greater rigidity. The cutting of Plugmold, however, depends on the fall of outlets. Generally, it is desirable to cut and mount the base first; then cut the cover so that the receptacles fall in the proper place. The edges should be faced upward to assure a straight cut.

The Wiremold 610A Cutting B
although designed for Plugm
2200, may be used to simplify furt
the cutting of all raceway, exc
2800 and 3000. The sides of the
have slotted guardways for the ha
saw to make 90° and 45° cuts
mitered corners.

WIREMOLD®

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In Canada: Conduits National Co., Ltd.
Toronto 2, Ontario

All WIREMOLD products are sold through electrical distributors — your best source for all electrical products.

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lete devices! I-T-E does the bussing in the ctory so you don't have to wire on the job! Only vo major components to connect — main dis-onnect and meter-breaker section. The elimina-on of separate wireways means faster installa-on and more meters in less wall space. Complete ussing also assures **lower total cost.** You merely ire in service to the main disconnect . . . and ire out distribution from the breakers.

Wall mounted meter centers are available for ervices through 600 Amps. Free standing island ype meter centers are available for services nrough 2000 Amps. Installations from the smallest p to 100 **or more** meters are no problem with these uperior designs.

DESCRIPTIVE BULLETIN AVAILABLE!

or additional information on famous-quality I-T-E letering Systems, ask for Bulletin 9001 from your -T-E Authorized Distributor, local I-T-E District ffice, or write to I-T-E Circuit Breaker Company, 25 Bennett St., N. W., Atlanta 9, Ga.

or the Contractor who is Proud of his work

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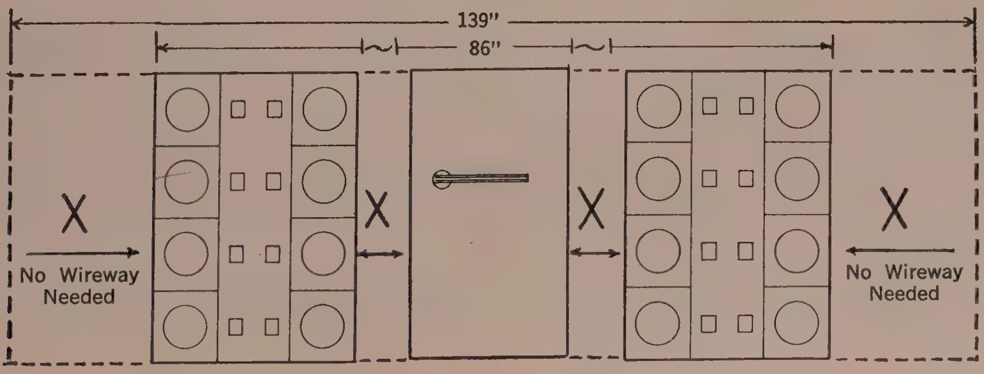
METERING SYSTEMS

SAVE

UP TO 70% IN TIME



I-T-E CIRCUIT BREAKER COMPANY

WALKER DIVISION

FULL-VALUE
CERTIFIED
TRANSFORMER
GENERAL ELECTRIC

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- Faster shipment
- Complete service

NEW FROM GENERAL ELECTRIC

Now up to 2500 kva

GE ACCENT ON VALUE

amperproof pad-mounted transformers

new series of pad-mounted transformers heads Gen-ral Electric's expanding line to meet your commercial nd industrial power-distribution needs. The liquid-lled units are rated 750 to 2500 kva, 65 C rise.

esigned for underground distribution, these new nits are completely tamper-proof. Safety is assured y locked terminal compartment doors that enclose ll live parts. No costly overhead structure, under-round vault, or protective fence is required.

nstallation is faster and costs less because the ransformer and associated equipment are factory-ssembled in one unit. Lifting lugs are included for onvenient installation by crane. The door sill on the erminal compartment removes to skid or roll the unit nto position after conduit is stubbed up. Also, a new, mproved insulation system makes possible a lighter and smaller design in each kva rating.

For greater installation savings, the transformer can be located directly beside a building to reduce secondary runs. Cable connection is easy because of direct vertical access from compartment floor to bushings.

The clean lines of the transformer blend with any surroundings. Locate it inconspicuously in the rear of a building. Or place it in parking islands, on lawns, or beside buildings. By landscaping around it, the unit's lines will blend in even better.

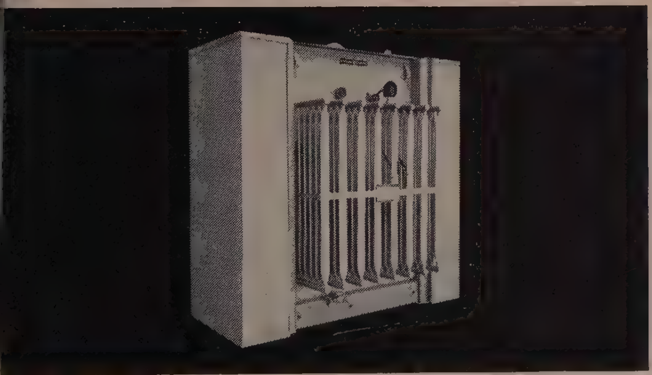
A wide choice of lightning protection, fusing, and switching equipment is available. For high-voltage terminations, fused disconnect, oil, and air switches are available for radial single source, radial dual source, and loop feed service.

The new pad-mounted transformers are but a part of General Electric's complete line of commercial and industrial transformers. Two other units are shown below: a **distribution equipment transformer** and an **integral distribution center.** Each warrants careful consideration by system planners.

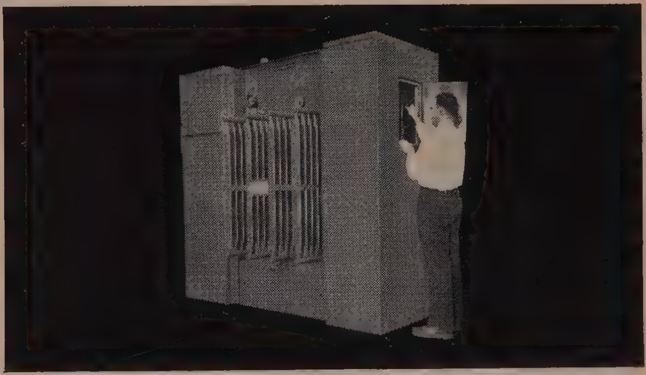
For full data, see your G-E Sales Engineer or write General Electric Co., Sect. 416-34, Schenectady, N.Y.

Medium Transformer Department, Rome, Georgia.

OTHER NEW EQUIPMENT FOR COMMERCIAL AND INDUSTRIAL APPLICATIONS



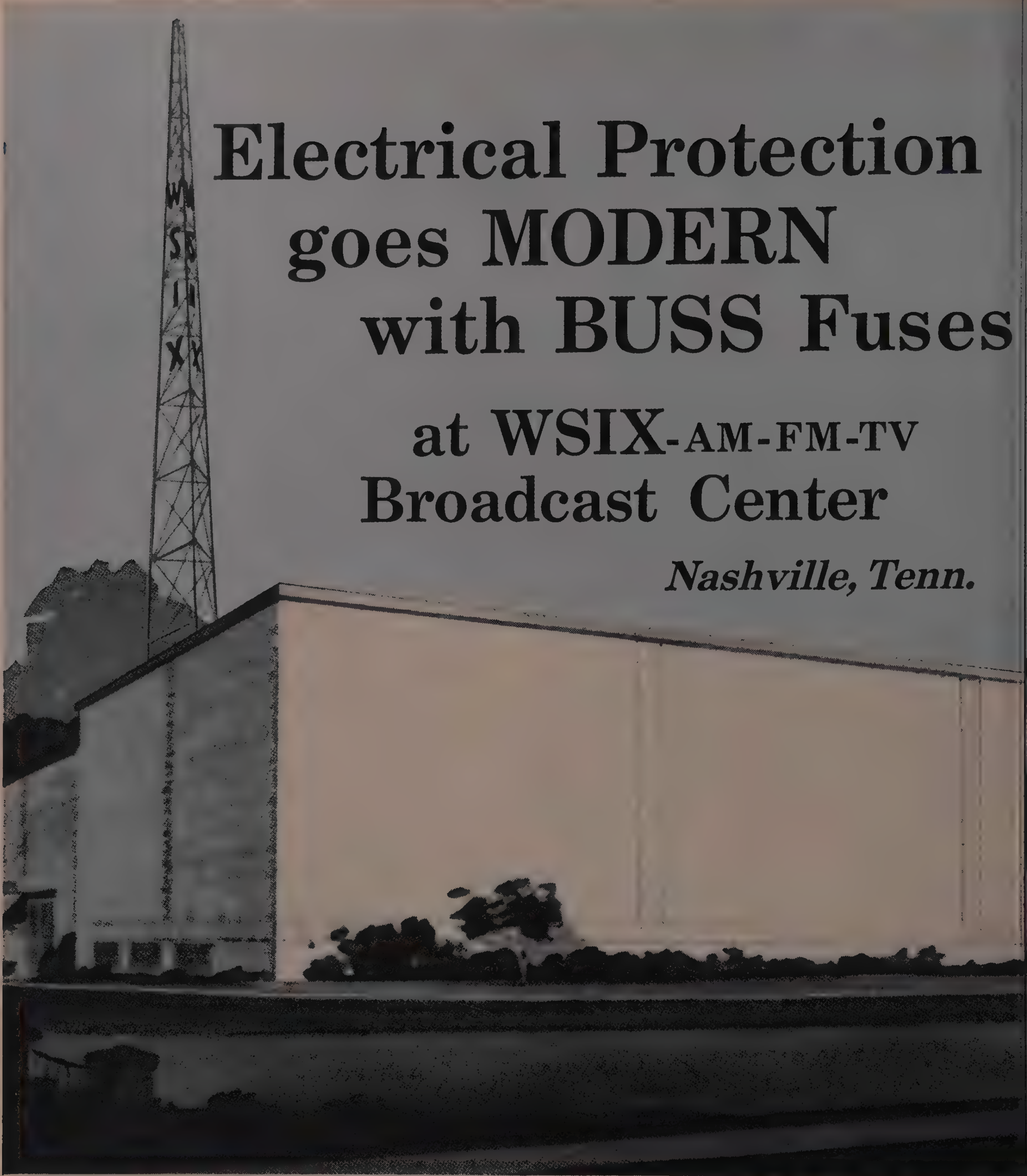
G-E DISTRIBUTION EQUIPMENT TRANSFORMERS provide the same service as pad-mounted units except that they are normally not tamper-proof, have end-to-end compartment arrangement. New design is significantly smaller, lighter.



G-E INTEGRAL DISTRIBUTION CENTERS are completely integral unit substations for industrial locations. Utilizing molded-case circuit breakers, they are delivered as one unit. They are easy to install . . . use minimum floor space.

Progress Is Our Most Important Product

GENERAL ELECTRIC



Electrical Protection goes MODERN with BUSS Fuses

at WSIX-AM-FM-TV Broadcast Center

Nashville, Tenn.

Down time can kill a radio or TV program... for the natural impulse is to flick the dial to a live station.

That's why WSIX demanded the finest possible electrical protection. Hence, BUSS fuses were installed.

WSIX protects its main service entrance with three 2000 ampere BUSS Hi-Cap fuses which have an interrupting rating of 200,000 amps. rms symmetrical. Thus, safe interruption of fault currents now available is assured,—and the fuses are adequately safe to allow for future system growth.

If a high fault should occur, the fast opening characteristics of BUSS Hi-Cap fuses further protect circuits and equipment against damage by restricting let-thru fault currents to low values,

BUSS: *the complete line of fuses*

Electrical Design: J. L. SIMPSON, JR., *Nashville, Tenn.*
Electrical Contractor: TRAVIS ELECTRIC CO., *Nashville, Tenn.*
Architect: BURKHALTER-HICKERSON & ASSOC., *Nashville, Tenn.*

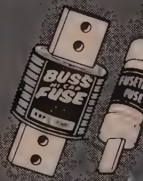
Feeder and Branch Power Circuit Protection

To further assure safe, modern protection, feeder circuits are equipped with BUSS Hi-Cap and FUSETRON fuses and branch power circuits are protected by FUSETRON fuses.

For modern, all-purpose electrical protection of circuits up to 600 amps, FUSETRON fuses cannot be equalled. They have an interrupting rating of 100,000 amps, rms symmetrical,—and their stronger time-lag holds harmless overloads to prevent senseless outages.

for more information on
FUSETRON dual-element fuses
... write for BUSS bulletin FIS
BUSS Hi-Cap fuses
write for BUSS bulletin HCS
BUSSMANN MFG. DIVISION, *McGraw-Edison Co., St. Louis 7, Mo.*

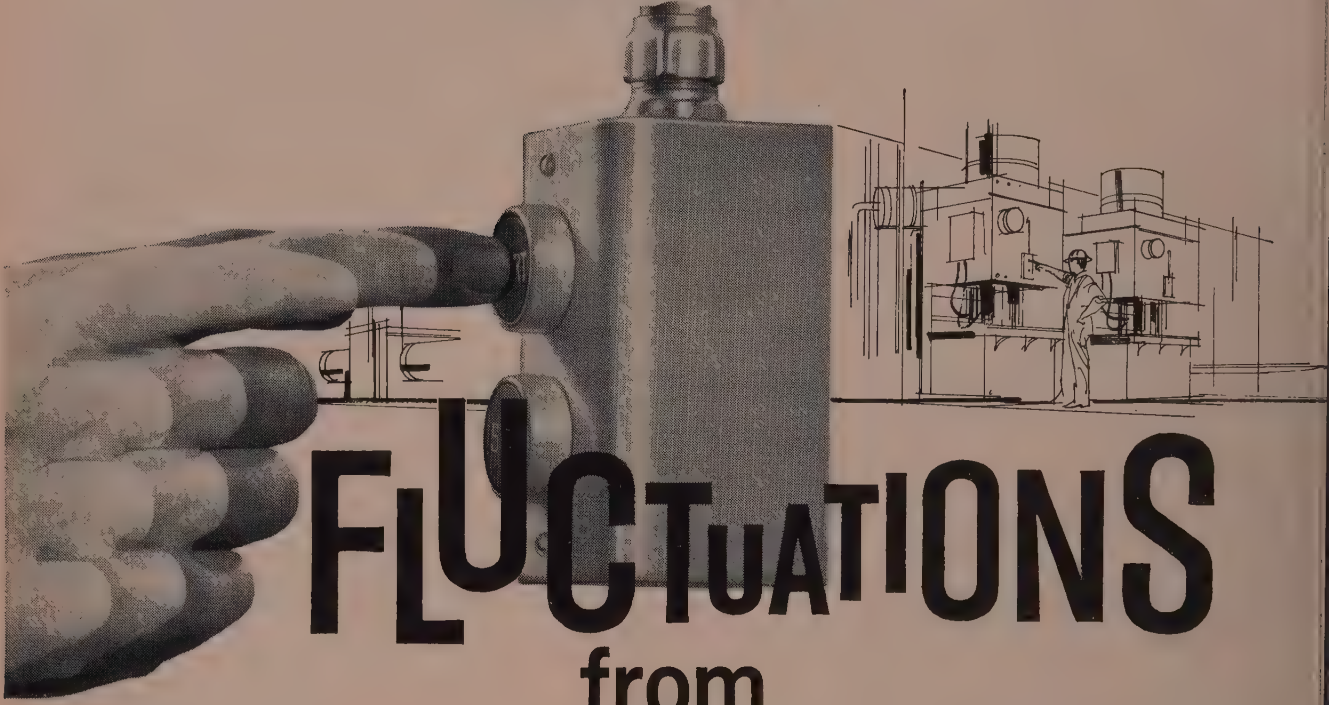
KEEP PACE ELECTRICALLY



with Safety!

of unquestioned high quality!

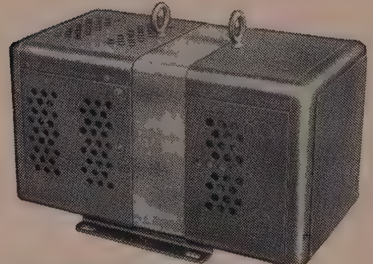
SOLAtron LINE VOLTAGE REGULATOR corrects



FLUCTUATIONS

from the very first cycle

Responds up to 10 times faster than electromechanical devices . . . irons out fluctuations due to both line and load changes! Voltage correction is practically *concurrent* with every disturbance; starts long before output voltage nears the boundaries of the regulation envelope. Even under extreme conditions, correction never takes more than one-sixth second. And *talk about reliability!* Solatron line voltage regulators eliminate moving parts; rule out mechanical wear and tear. Complete maintenance-free operation. Solid-state sensor monitors actual output . . . then regulates the transformer *flux* to automatically maintain correct nominal voltage.



SOLA

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Division of Basic
Products Corporation

SOLA ELECTRIC CO., 1717 Busse Road,
Elk Grove Village, Illinois, HEmpstead 9-2800

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Compare the advantages:

Superior performance — regulation ±
for line and load variations, zero to
load.

High efficiency — 95% or better at
load.

"Lifeguard circuitry" — withstands
mentary overloads many times rated
rent.

Input PF — 90% minimum on unity
loads.

Smaller, lighter—considerably more c
pact than other standard regulators.

Solatron line voltage regulators
offered in ratings from 3 to 100 k
for 120 and 240 vac, 60 and 400 cyc
For more information contact y
local Sola distributor or call us dir

Typical commercial and light industrial applications of Westinghouse 100 ampere Bus Duct...

(machine shops ~ repair garages ~ supermarkets ~ high bay lighting ~ woodwork shops ~ computing equipment ~ conveyor lines ~ schools ~ telephone companies ~ service entrance panels ~ aircraft industry ~ metal stamping ~ electronic industry ~ lumber mills ~ automotive industry ~ motels ~ frozen food industry ~ automatic laundries ~ control-type panel-boards ~ recharging battery carts ~ auditoriums and exhibition halls ~ test benches for laboratories ~ shopping centers ~ candy factories ~ sub-feeders ~ electric plants ~ air conditioning ~ conveyor lines ~ production lines ~ steel fabrication plants ~ canneries ~ dry kilns ~ hospitals ~ plate glass manufacturing ~ electroplating plants ~ drug manufacturing ~ lighting for either 120/208 or 277/480 volts ~ TV studios ~ test cells for aircraft ~ instrument manufacturing ~ aluminum industry ~ shipyards ~ feeder for under-floor duct)

...just to mention a few

You name the application—if small blocks of ower are needed, 100 ampere Westinghouse us duct gives you these advantages over conduit and cable. **Snap-together joints** eliminate need for bolts, straps or couplings. **Only one hanger** is eeded for a 10-foot length and two men can nstall it easily. **Two usable plug-in outlets** every wo feet provide easy power take-offs. To relocate busway, simply unsnap the bus duct, nove to new location, snap it together again.

Westinghouse

Available in 10, 5, 3, 2 and 1-foot lengths with an outlet in every length. **Cost?** This completely flexible duct can be installed at a tangible savings over all conventional systems.

To save money on your next installation or remodeling job, check into these advantages of 100 ampere bus duct. Ask your Westinghouse representative, or write to Westinghouse Electric Corporation, Standard Control Division, Beaver, Pa. *You can be sure... if it's Westinghouse.*

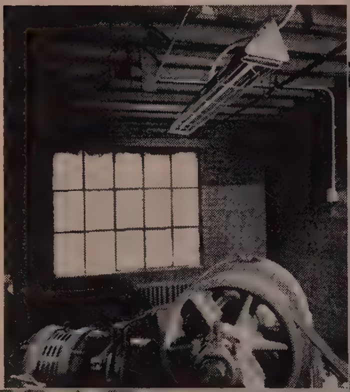
THE RUSSELL INDUSTRIAL CENTER
2 MILLION SQ. FT. OF INDUSTRY
Electrically Heated Where Heat's Critical

Electrical Contractor
Van Norman Electric Co., Inc.

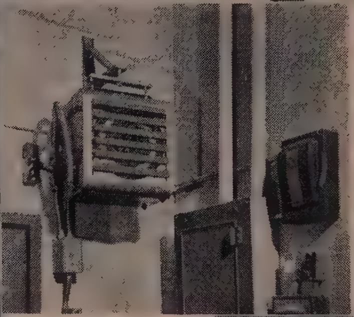
Electric Heating Specialist
Robert V. Pollock, Detroit Edison Co.

®**Electromode** heat, an integral part of the remodeling of the Murray Corporation buildings, is helping to make them a valuable property again. Abandoned and inactive when the Murray Corporation moved out, 60 per cent of the two million square foot complex is now leased—bustling and busy, as the Russell Industrial Center. The unmatched comfort of electric heat used in the Center increases employee productivity. This, and the advantages of low maintenance, reduced space requirements and high safety have made electric heat a key sales point in bringing the buildings back to life. The illustrations show Electromode is installed from the roof (14 elevator penthouses) to the basement, and in much of the space between. The present large and growing occupancy of the Center proves it was a wise decision.

To prevent elevator machinery from freezing up, yet without wasting heat on unused space, the Russell Industrial Center's 14 elevator penthouses are equipped with Electromode Quartz-one Tube Heaters, as illustrated.



Office of the Gates Rubber Company, a Russell Industrial Center tenant. Note trim, space-saving design of Electromode Low-Level Baseboard Units.

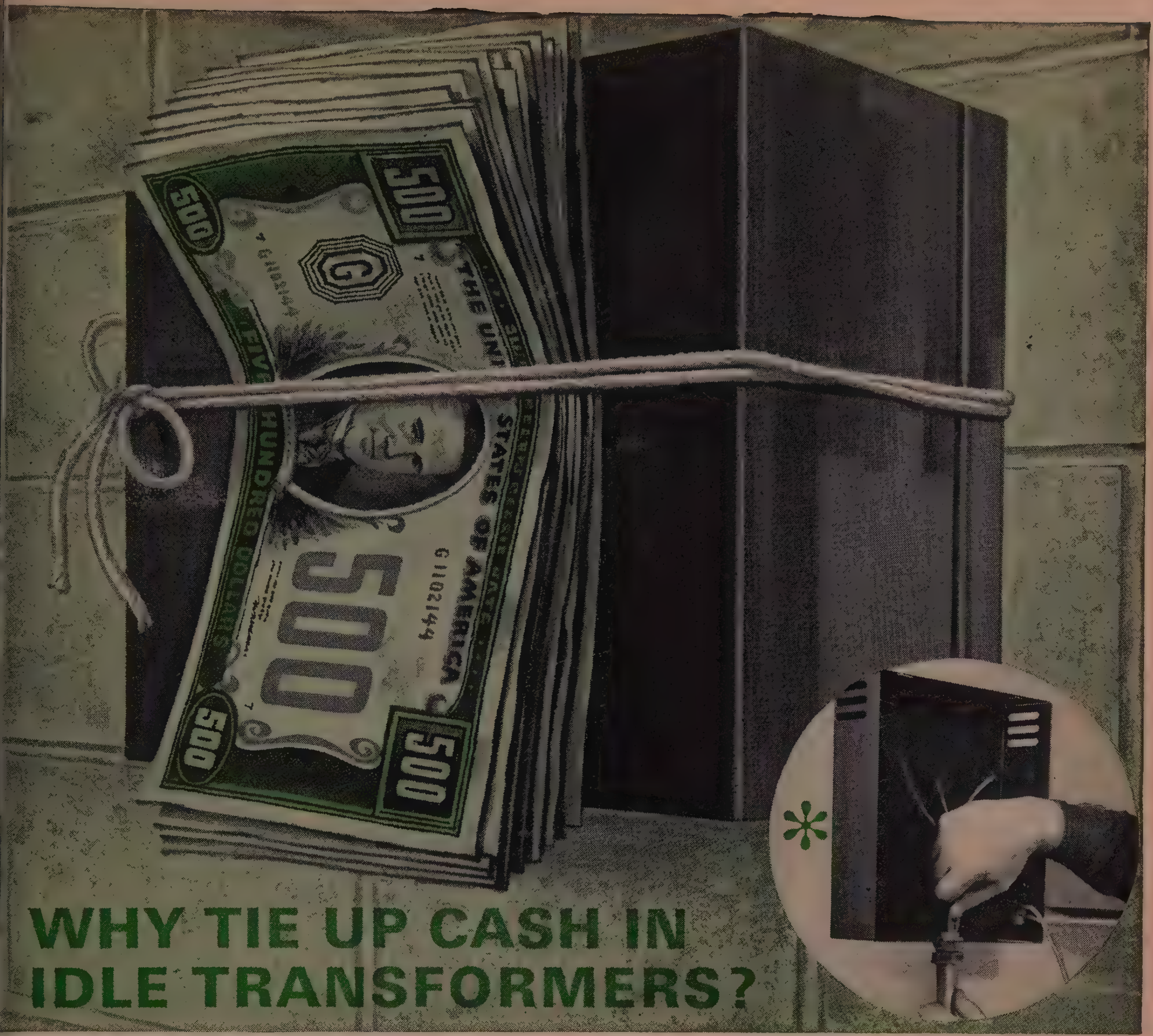


Stairwells and corridors throughout the Russell Industrial Center are heated with Electromode Suspension Heaters, for Completely uniform heat distribution.

Another Russell Industrial Center tenant, the Feetwing Corporation, receives fan-circulated comfort from Electromode surface mounted Down-Flo Wall Units.

The photo shows an Electromode thermostat as it appears on an Electromode Baseboard Unit installation in the Russell Industrial Center. These precision controls are also available in tamper-proof models, if required.

®**Electromode** *Division of Commercial Controls Corporation* ROCHESTER 3, N. Y.
Dept. ECM-112



Allis-Chalmers separate rear panel lets you complete all system wiring fast! And you purchase transformers only when construction nears completion

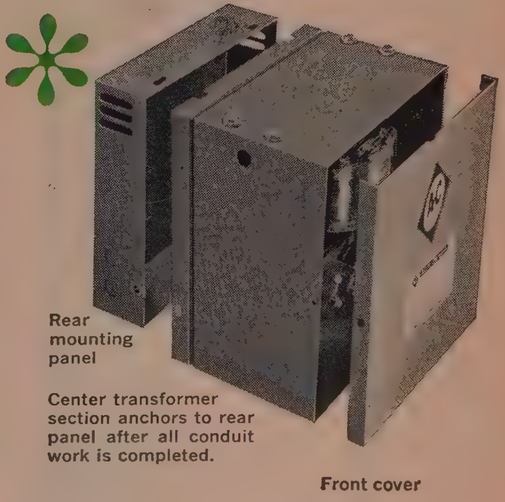
You save BIG with A-C 3-piece transformers! Need to install 20 dry-type units, for example? Pick up just the rear panels from your A-C distributor. Mount 'em and complete your conduit work. Ninety per cent of your installing job is done. Use the panels as temporary junction boxes if you wish.

Weeks later, pick up the transformer section and cover plate for each A-C unit. In less than 10 minutes per unit, you'll finish the job. And you've kept the transformers out of the general construction dirt.

Most important, you don't tie up your money in *complete-unit* dry-type transformers for weeks at a time. All you need initially is the back mounting panel if it's an Allis-Chalmers *exclusive 3-piece case unit!*

Available only from A-C, these 3-piece case, dry-type, ventilated transformers (600-volt class, indoor) are offered in 10 sizes, from 3 to 45 kva. *Call your nearby A-C office for free Bulletin No. 61B8222C or write Allis-Chalmers, Box 512, Milwaukee 1, Wis.*

A-1663



Center transformer section anchors to rear panel after all conduit work is completed.

ALLIS-CHALMERS

WHEN YOU'RE WIRING FOR

BE SURE IT'S WITH CORNISH

When you're installing sound and communicatio systems, radio or TV hook-ups—count on Cornis to furnish the wire and cable you need. At Cornis you'll find complete selections of shielded and u shielded, single and multipair intercom, sound an coaxial cables. They are available in many require conductor sizes, a wide variety of insulations an jackets, made to the tightest specifications. ☐ Se Cornish, too, for the really complete lines of heav duty extensions, cord sets, flexible cords an portable Power-Lite lines. Distributors are ever where—coast to coast. Cornish Wire Company, 50 Church Street, New York 7, New York.

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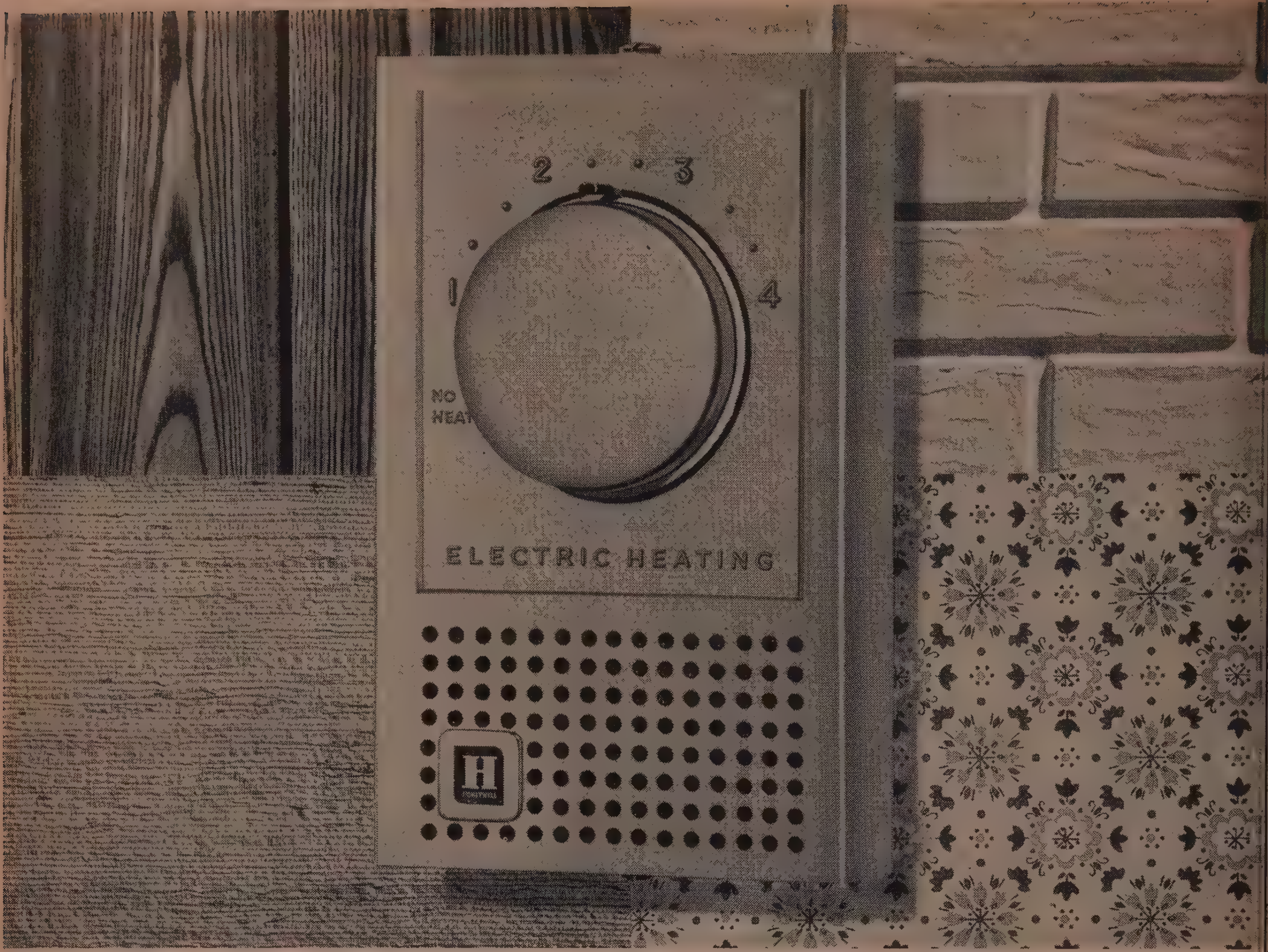


Put the Honeywell preference to work for you with the stylish

New Honeywell Line-Voltage Electric Heat Thermostat

When Honeywell is on the wall, you're offering what Homeowners want (3 out of 4 prefer Honeywell controls according to a recent survey in cities across the country).

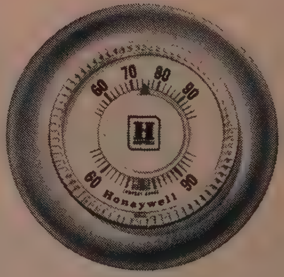
The wall-mounted T462 (above) and its integral unit-mounted counterpart—the T460—are the ideal line-voltage home thermostats. New construction makes them stronger. Now easier to set, too. Rugged and dependable—yet precise (½° differential) switching for operating electric heaters up to 5000 watts, responding to both radiant and convected room heat.

Get the facts about Honeywell. Just call the nearest Honeywell office or write: Honeywell, Dept. EC11-25, Minneapolis 8, Minnesota.

Two switching variations available: T462A and T460C are SPST, make on temperature fall, break line in NO HEAT position. T462B and T460D have the added feature of breaking both lines in the OFF position.

NEW, EXCLUSIVE ELECTRIC HEAT TRAINING PROGRAM! Another Honeywell first! Sales and service meetings studying a new and thorough working manual: "Fundamentals of Automatic Electric Heating." Call the Honeywell office nearest you about the next session.

Honeywell
Low-Voltage
Round

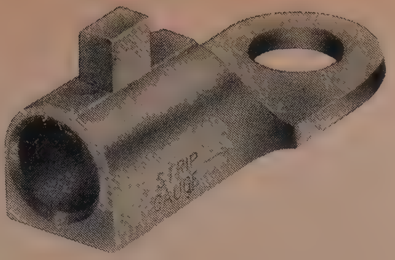


Consider Honeywell low-voltage controls, too. With vers tile R8097 Relay, you can offer the widest range of lo voltage thermostat combinations in the electric heati industry. You have complete choice from the mo economical to the famous Honeywell Round to the delu thermostats and Control Centers.

Honeywell

H HONEYWELL First in Control

NDERSON'S TOP TEN IMESAVERS



1. TYPE JL "HAMRON"* Terminal Lug • Simplest terminal lug yet developed • Cannot over compress • Maintenance free • Eliminates special tools (a hammer and a flat surface is all you need) • Four sizes cover wire range from #6-300 MCM

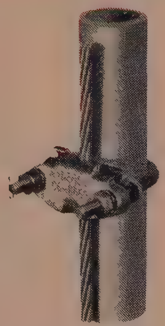
2. TYPE "TS" All Purpose Connector • Great job versatility • Able to join ranges of cable, tubing, flat bus bar and solid rod or any of their combinations to make tee taps, couplers, elbows and parallels • Recommended for emergency stocks • Ruggedly designed for heavy duty service

ANDERCRIMPS"* • Complete line of insulated uninsulated terminals, junctions, splices disconnects to cover wire ranges from solid through #2 stranded

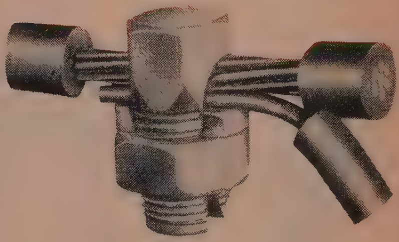
4. BAR CLAMPS and INSULATORS • Anderson offers a complete line of bar clamps, bus supports and indoor insulators. Bar clamps and supports are available to cover bar widths up to 6″

5. CAST ALUMINUM JUNCTION BOXES • Easier to handle and install on the job because of their light weight. Require no maintenance • Faster to drill and tap than the cast iron type

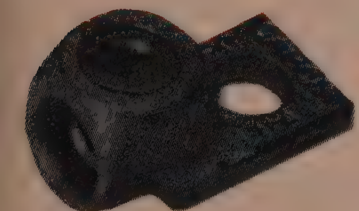
TYPE "XP" MULTI-CONNECTOR • For compact taps, splices, crosses and parallels • Few es cover broad range • Quick to install and ily taped • Ten sizes cover wire range from Str.-1000 MCM



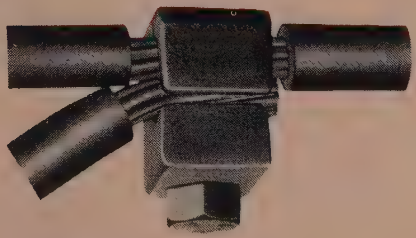
7. TYPE "GC-111" GROUNDING CONNECTOR for WIRE to PIPE or ROD • Two-way groove provides parallel (as shown) or 90° connections. Complete line to cover ¼″ through 4″ IPS and #8 Sol. through 800 MCM



8. TYPE "C" SPLIT BOLTS • All components of high strength silicon bronze • High clamping pressure obtained with very smooth chemically treated machine cut threads • All sizes available to cover wire range from 14 Sol. through 1000 MCM



TYPE "LU" SET SCREW TERMINAL LUGS • npact dimensions yet have wide clamping ge. High conductivity copper alloy with s set screw. Available with one- two- or e-cable barrels and with one- two- or four- tongues. Also offered with hex head ws • Complete line available to accom- ate wire range from 14 solid through 1000 M



10. TYPE "DG" VISE ACTION CONNECTOR • One piece design installs without disassembly • No loose pieces to handle. Require no special tools. Round edges facilitate fast taping. DG's come in eight sizes which cover the complete range from #14 Sol. through 4/0 stranded copper

For full information on these products, contact your Anderson representative — or write Anderson Electric Corporation, Leeds, Alabama.

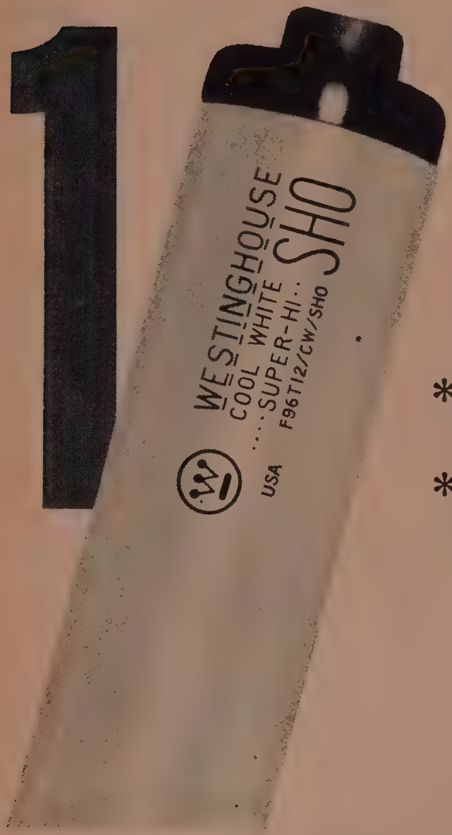
SOLD
THRU
AUTHORIZED
DISTRIBUTORS

*

ANDERSON ELECTRIC
CORPORATION

The most important productio

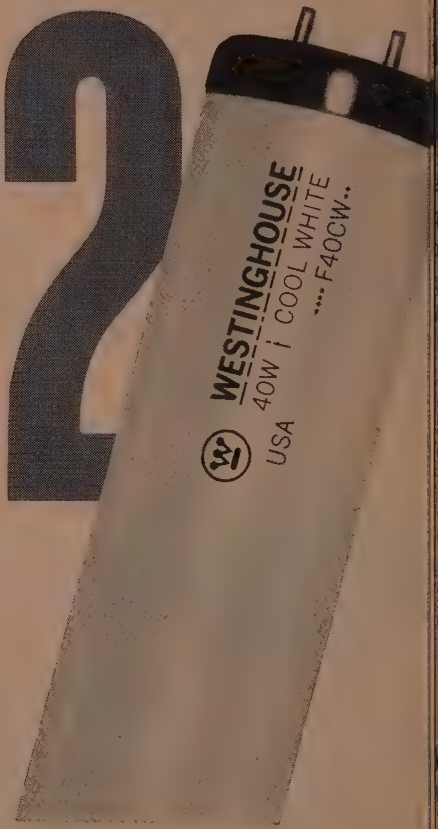
Here are 3 ways to give them



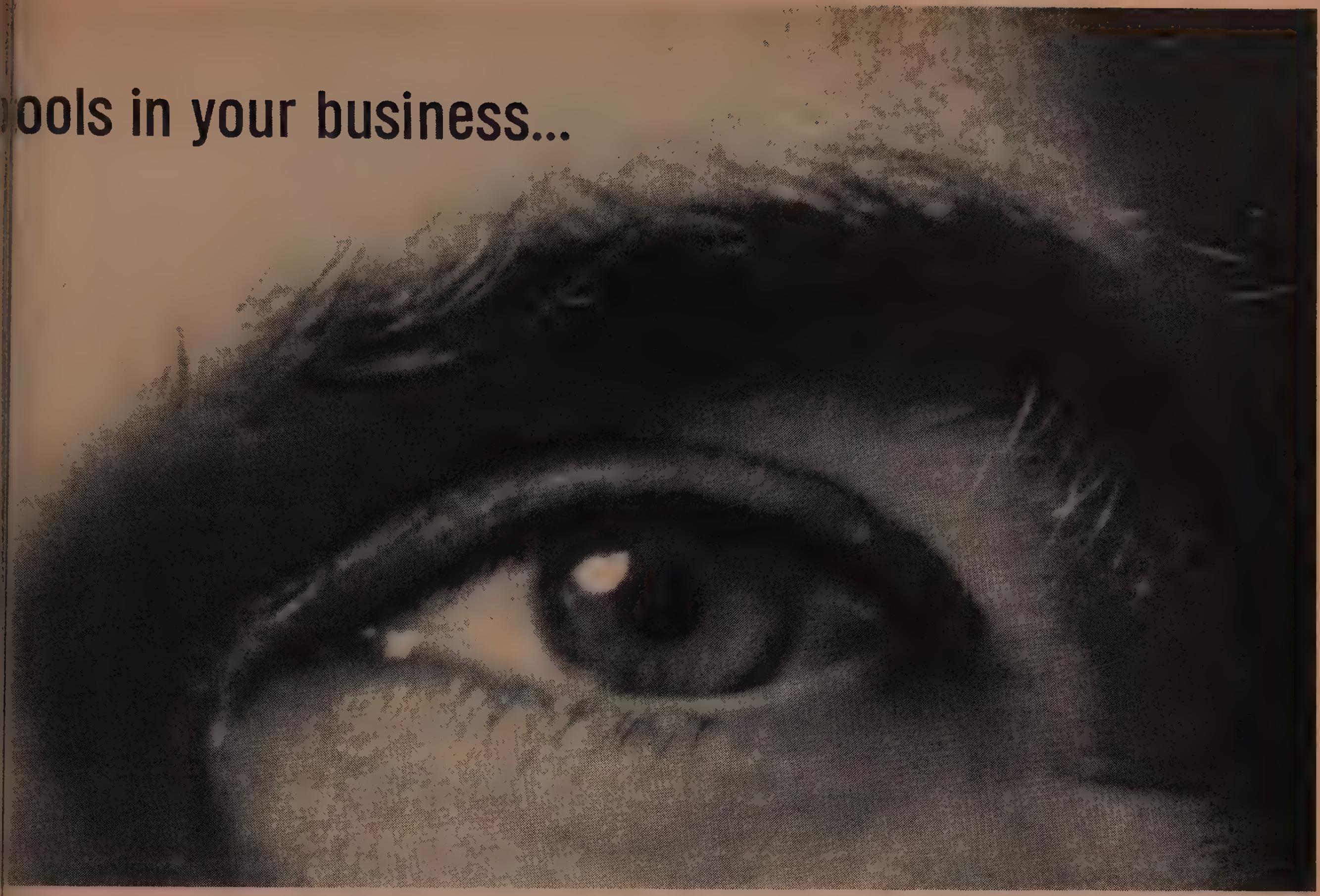
Get more light per dollar

in Super High Output (1500 ma) Systems! Design breakthrough makes new Westinghouse "Code 230" Super-Hi™ Output fluorescent lamps yield more light throughout their long service life—and cost less, too!

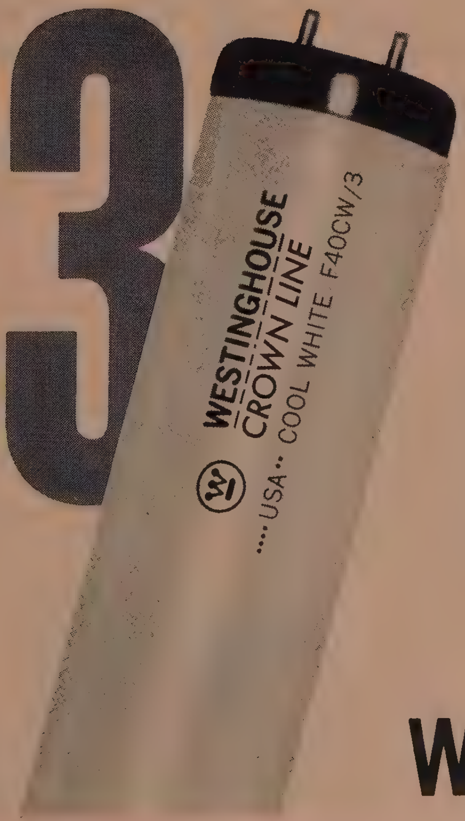
- *** In present installations, Westinghouse "Code 230" SHO lamps are the ideal replacement. They cost less, give more light, have longer life ratings.**
- *** In new installations these lamps deliver the maintained light levels you require with fewer fixtures to give you an immediate bonus saving.**



ools in your business...



more light...for less money!



Cut costs in your present 40 watt system

New longer life rating of Westinghouse tandard line fluorescent lamps cuts purchase and replacement labor costs by one quarter. These lamps sell at regular prices, make the best buy for existing 40 watt systems.

Cut installation costs on new 40 watt systems

with Westinghouse Crown Line fluorescents at regular prices. Crown Line lamps deliver higher light output . . . you'll need 5% fewer fixtures in new installations. If you're building or rewiring, get in on this big saving!

Why not pass this ad along

to your Purchasing Agent? Your local Westinghouse Lamp Representative will be glad to show him how your company can cut costs with these economical lamps. Remember, you can be sure . . . if it's Westinghouse!

Westinghouse

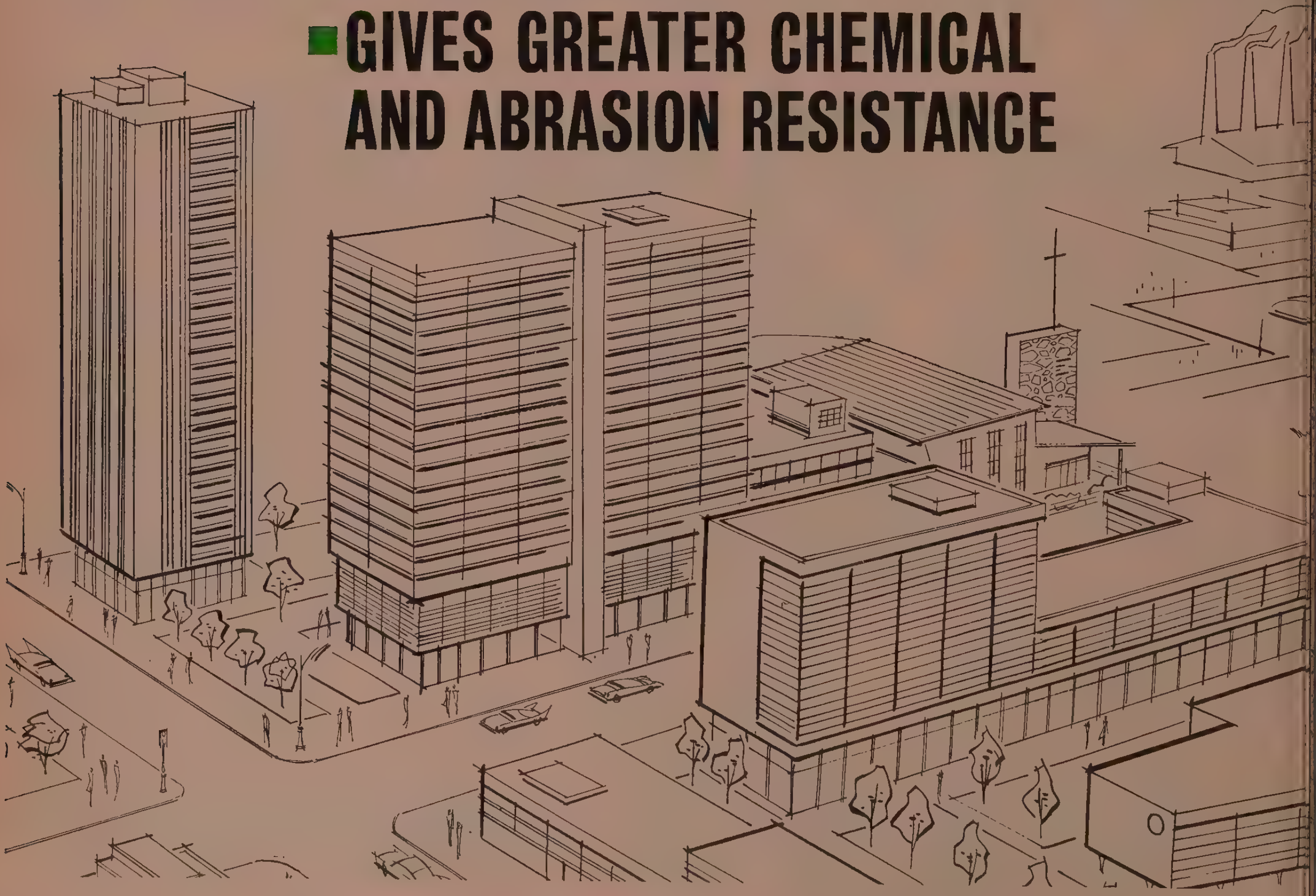
Westinghouse Lamp Division
Westinghouse Electric Corporation, Bloomfield, N.J.

ANNOUNCING A NEW TYPE OF BUILDING WIRE

U/L LISTED THWN WIRE WITH ARMOR OF DUPONT ZYTEL®

NYLON RESIN

- CUTS INSTALLATION COSTS
- SAVES SPACE
- GIVES GREATER CHEMICAL AND ABRASION RESISTANCE



y recognized Type THWN s specifically designed to meet gid electrical needs of modern trial, commercial and residen- ccupancies. It fills the need more durable building wire combines reduced bulk with ised reliability. It is recognized e in wet or dry locations and nperatures up to 75°C.

pe THWN wire, developed by c Wire & Cable Corporation, t City, Connecticut, provides xtremely tough armor of ont ZYTEL nylon resin over an opriate wall of U/L listed C. PVC insulation. It is recog- in the 1962 edition of the onal Electrical Code.

pe THWN offers several very ical advantages:

• • •

ler diameter, lower installed s on rewiring work. The unique erties of the armor of ZYTEL it reduction in the primary- ation thickness, resulting in a antially smaller over-all wire eter. This should save on re- g work. Note the charts below.

Increased abrasion resistance . . . substantially greater than most standard THW wires at room temperature. Due to the exceptionally tough jacket of ZYTEL nylon resin, Type THWN wire resists skinback and cut-through. It is also highly resistant to cold flow and may be used over a wide temperature range.

Longer, faster conduit pulls. Frictional properties between wire and conduit are reduced from 20% to 40%. Tests prove that the smooth, tough armor of ZYTEL allows Type THWN to be pulled twice as far, or around twice as many bends as most Type THW wire.

Better chemical resistance. Type THWN wire is highly resistant to a wide range of chemicals, vapors and fumes. Such added protection makes it ideal for use in many extra-demanding environmental conditions.

During the past year, more than a million feet of Type THWN wire has been installed in plants and buildings of leading companies. Its properties make it extremely versatile in a number of applications:

- uses of standard building wire.
- in air or raceways where there may be exposure to or contact with oil, petroleum products, vapors, condensation or accumulation of moisture.
- power and/or control wiring in air, conduit or raceways, in wet and dry locations.
- rewiring, enabling the *largest* increase in circuits and amperage in existing conduit or raceway.
- a universal type of wire that has the potential of eliminating the need for storing large stocks of many other types of single-conductor building wire and cables.

For complete information on the performance, advantages and uses of this new wire and the unique properties brought about by the use of ZYTEL nylon resin, write: Du Pont Co., Plastics Dept. EC-11, Rm. 2507Z Nemours Bldg., Wilm. 98, Del.

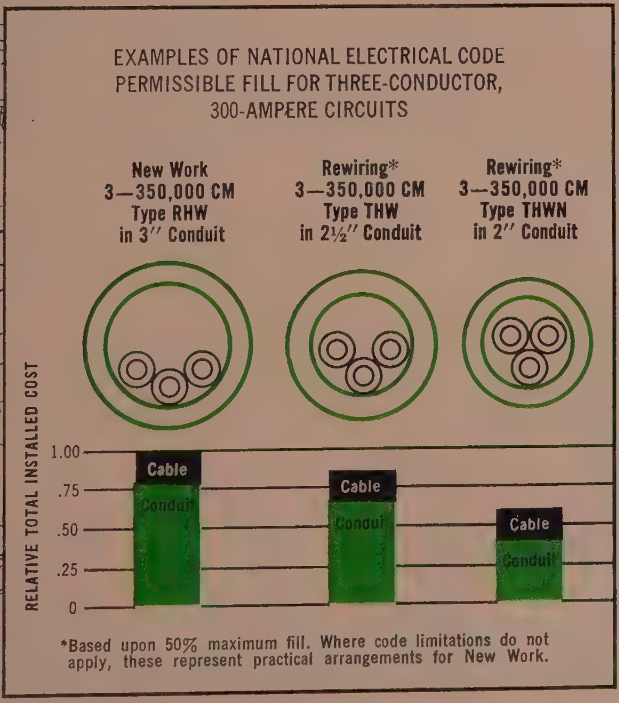
Du Pont does not make wire and cable, but supplies thermoplastic resins to the wire and cable industry.

PLASTICS DEPARTMENT

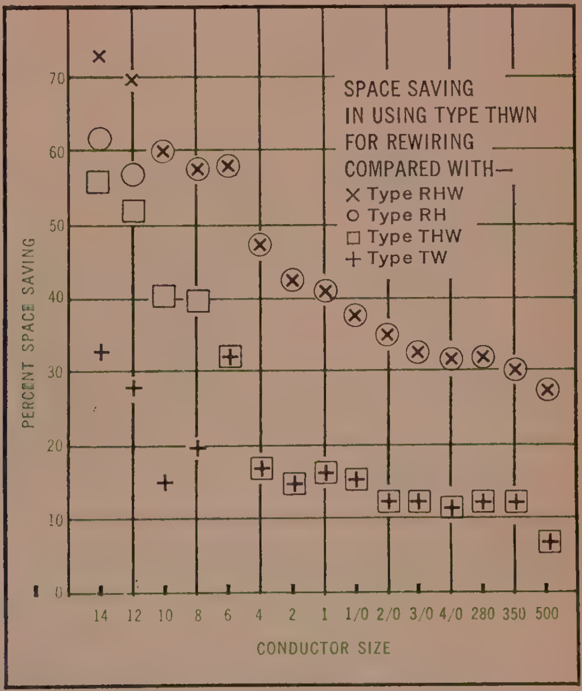
DU PONT
REG. U.S. PAT. OFF.

ZYTEL®
NYLON RESINS

Better Things for Better Living . . . *through Chemistry*



*Based upon 50% maximum fill. Where code limitations do not apply, these represent practical arrangements for New Work.



FROM THE GROUND UP
PROFESSIONALS SPECIFY SAFETY
PROVEN, DEPENDABLE & VERSATILE
...P&S 5262 3-WIRE GROUNDING DEVICES
FIND OUT WHY

Write Dept. ECM-1162
PASS & SEYMOUR INC.
SYRACUSE 9, N. Y.
BOSTON CHICAGO LOS ANGELES SAN FRANCISC

ADVANCE In-warranty Labor Insurance compensates for normal ballast replacement labor cost

ADVANCE IN-WARRANTY LABOR INSURANCE
ILI
ADVANCE TRANSFORMER CO.

what is ILI?

The ADVANCE TRANSFORMER CO. ILI (In-warranty Labor Insurance) Program is designed to reimburse the Electrical Contractor for normal labor costs incurred in replacing ADVANCE In-warranty High Power Factor Fluorescent Lamp Ballasts.

ILI permits the Contractor to guarantee both labor and ballasts in fluorescent lighting installations. It gives fast and more efficient service for lighting equipment manufacturers' products if an ADVANCE Ballast becomes inoperative within the two-year warranty period.

Here's how ILI works . . . .

1

The Electrical Contractor contacts his ADVANCE Representative when he experiences an ADVANCE in-warranty ballast failure. The ADVANCE Representative will qualify the job and issue an (In-warranty Labor Insurance) ILI number.

AUTHORIZED ADVANCE SERVICE-STOCKING DISTRIBUTOR
BALLAST ELECTRICAL SUPPLY COMPANY

2

The Electrical Contractor takes the inoperative ballast together with the (In-warranty Labor Insurance) ILI number to any ADVANCE Service-Stocking Distributor. The Distributor supplies the Contractor with new ADVANCE Ballasts at no charge and gives the Electrical Contractor an ILI form.

3

The Contractor completes and sends the form to ADVANCE TRANSFORMER CO., 2950 N. Western Avenue, Chicago 18, Ill. He receives a non-negotiable check for replacement labor cost which will be redeemable in merchandise at any ADVANCE Service-Stocking Distributor.

WRITE FOR COMPLETE ILI BROCHURE

"The Heart of the Lighting Industry"®

ADVANCE®
TRANSFORMER CO.
CBM CERTIFIED by ETL
WORLD'S LARGEST EXCLUSIVE MANUFACTURER OF FLUORESCENT LAMP BALLASTS
2950 NO. WESTERN AVE. CHICAGO 18, ILL. U.S.A.

coolest

Wheeling Steel knows the value of cooler safety switch operation. Hundreds of Westinghouse switches have given years of trouble-free performance at their Steubenville, Ohio, plant.

Cool switches last much longer, and Westinghouse makes the coolest safety switch you can find.

Take the contact area, for instance, where most heat is produced. An exclusive Westinghouse design has completely eliminated arcs from the contact area. Burning and beading don't exist there. Contacts last longer.

The De-ion arc quencher reduces heat by snuffing out arcs quickly. Joints produce heat, so Westinghouse eliminates joints with one-piece copper construction. Heat is reduced, and conductivity is improved.

Tin-plating of copper parts further reduces both heating and wear by providing lubrication, and corrosion resistance. These features help make Westinghous the best buy in safety switches. Ask your Westinghouse representative for complete details or write Westinghouse Electri Corporation, Standard Contro Division, Beaver, Pa. *You can b sure . . . if it's* **Westinghous**

J-3034

Murray introduces the New Look

..in its Trade-Mark and in its Load Centers

MURRAY

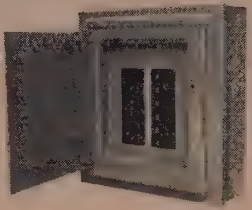
There's a snappy new look to Murray's ade-mark that is symbolic of a major reakthrough in style...in quality...and n service.

New designs and new manufacturing echniques bring you top value and fast eliveries in electrical distribution equip-ent.

First of Murray's products to get the new look" is our line of MP Load Centers. No need to hide this stylish unit in an out-of-the-way location. You'll be proud to install it in a convenient spot in full view of your customer.

Murray Load Centers also offer distinct design features that mean easy installation and long, trouble-free service life. What's more, you can equip them with our MP Guaranteed for Life, fully magnetic Circuit Breakers.

Find out how you can put Murray's "New Look in Load Centers" to work for increased sales and higher profits. See your Murray distributor, or write to Murray Manufacturing Corporation, 1250 Atlantic Ave., Brooklyn 16. N. Y.



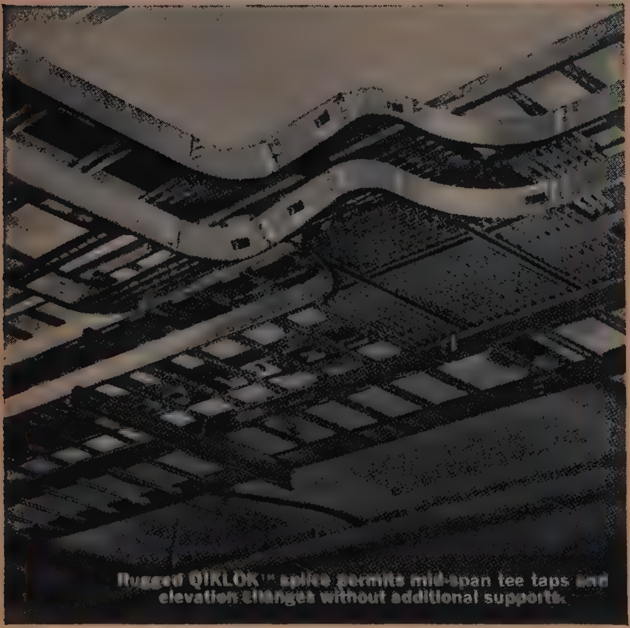
Easy-opening door has unbreakable snap-lock. No obtrusive handles.

Equipped with the Only Guaranteed for Life Fully Magnetic Circuit Breaker.

HUSKY Cable Support Systems . . .
Meet New NEC Grounding Requirement*

Engineering margin designed into all HUSKY systems provides for present and future requirements.

A System For Every Application . . .



Rugged QIKLOK™ splice permits mid-span tee taps and elevation changes without additional supports.

Complete cable support systems (with structures) provides economical approach to modernization.

. . . A System For Every Budget!

*For copy of NEC Article 318 (National Electric Code) and comparative installation cost studies of HUSKY products write

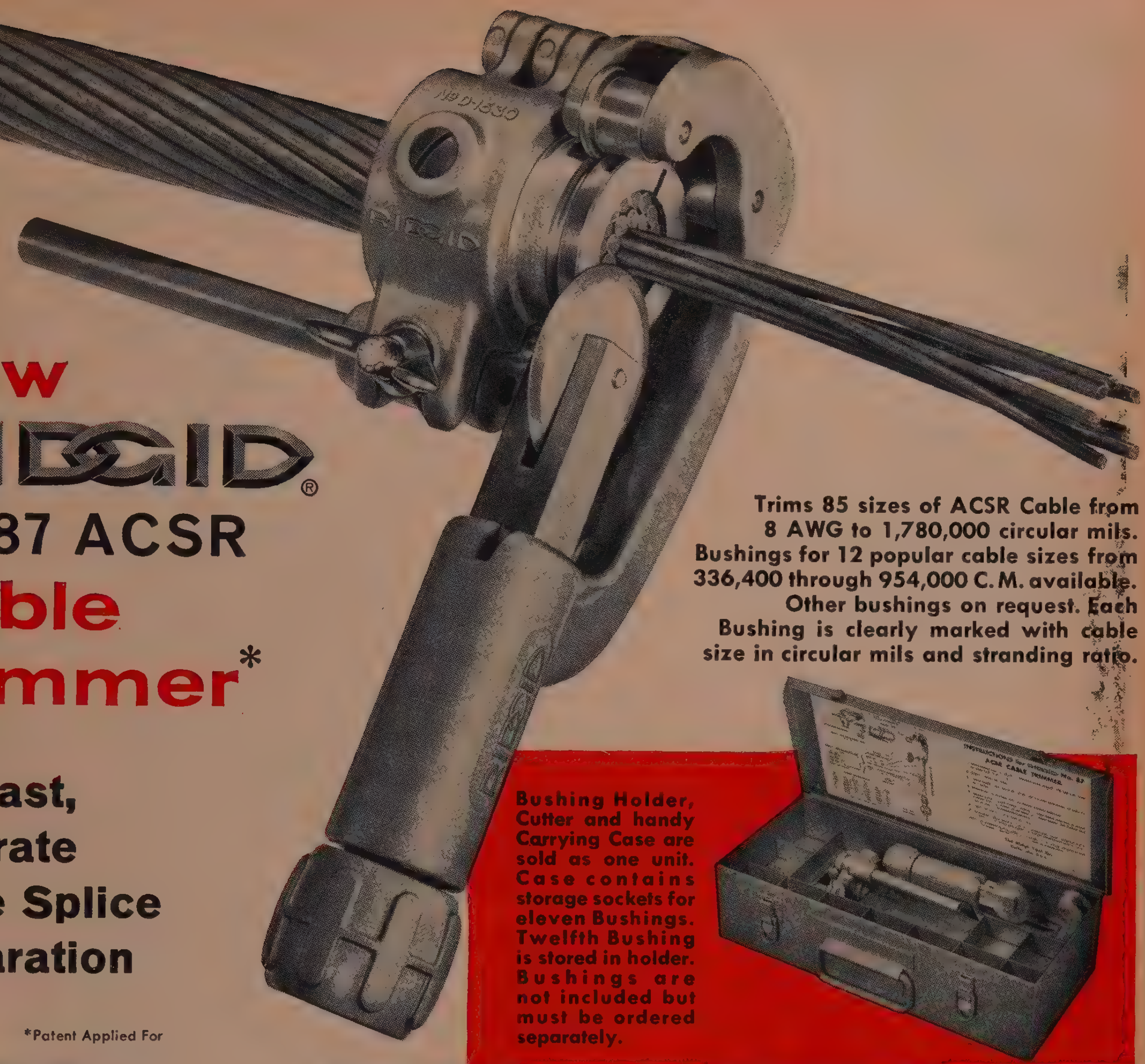
HUSKY PRODUCTS, INC., *DIV. OF* **BURNDY CORP.**

5300 VINE STREET, CINCINNATI 17, OHIO

62-

New RIDGID® No. 87 ACSR Cable Trimmer*

For Fast, Accurate Cable Splice Preparation



Trims 85 sizes of ACSR Cable from 8 AWG to 1,780,000 circular mils. Bushings for 12 popular cable sizes from 336,400 through 954,000 C. M. available. Other bushings on request. Each Bushing is clearly marked with cable size in circular mils and stranding ratio.

Bushing Holder, Cutter and handy Carrying Case are sold as one unit. Case contains storage sockets for eleven Bushings. Twelfth Bushing is stored in holder. Bushings are not included but must be ordered separately.

*Patent Applied For

1

Select proper size Bushing. C. M. size and stranding is clearly marked on each half. Screw Bushing halves to hinged Holder.

2

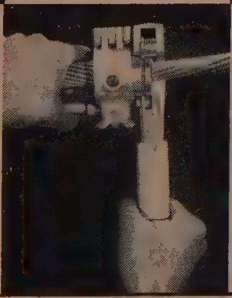
Place Holder and Bushing around cable with exposed end of Bushing at point to be trimmed. Clamp Holder securely.

3

To position Cutter, insert flanges of both rollers in guide groove on exposed Bushing end. Adjust cutter wheel by turning feed screw knob.

4

Revolve Cutter around cable while feeding in cutter wheel. Guide groove keeps Cutter straight. Wheel hub contacts Bushing to stop cut just before last strands are completely severed.



5

Retract cutter wheel and remove Cutter from cable. Break off remaining partially severed aluminum strands by hand.

6

After trim cut, loosen wing nut and move Bushing and Holder back from trimmed end. Retighten to hold strands in place until splice is completed.

Field tests prove that revolutionary new RIDGID No. 87 ACSR Cable Trimmer reduces cable preparation time by as much as 70%. Operation, similar to conventional tubing cutter, is fast and easy. Rugged, aluminum alloy construction assures light weight and long service life.

Call Your Supply House!

RIDGID®

The Ridge Tool Company · Elyria, Ohio, U.S.A.

*** KILLARK "GR" SERIES JUNCTION BOX . . .**

available in eight sizes from 4⅝" x 4⅝" x 4½" to 11" x 12" x 8¼". Choice of dome covers in four heights to facilitate heavy splicing or mounting terminal blocks. Also available with flat blank covers or lens covers for instrument mounting. Lens is heavy shock proof, stressed glass, as strong as the casting.

Copper-free aluminum casting with reinforced construction and convenient mounting lugs. Custom hubs can be placed where needed; drains and breathers available. Explosion-proof, dust-tight, and weatherproof.

There are more than 200 other Killark Junction Boxes from which to choose the exact style and size you need for any installation.

Write for illustrated catalog.

"Any size and style you need—because the Killark line is complete!"

OVER 7,500 ELECTRICAL FITTINGS AND FIXTURES

Only Killark provides copper-free aluminum equipment in such a complete range of sizes and styles. Having the right enclosure available for the application means greater design freedom, better operating efficiency, lower costs.

YOU GET FAST DELIVERY ON KILLARK ELECTROLETS

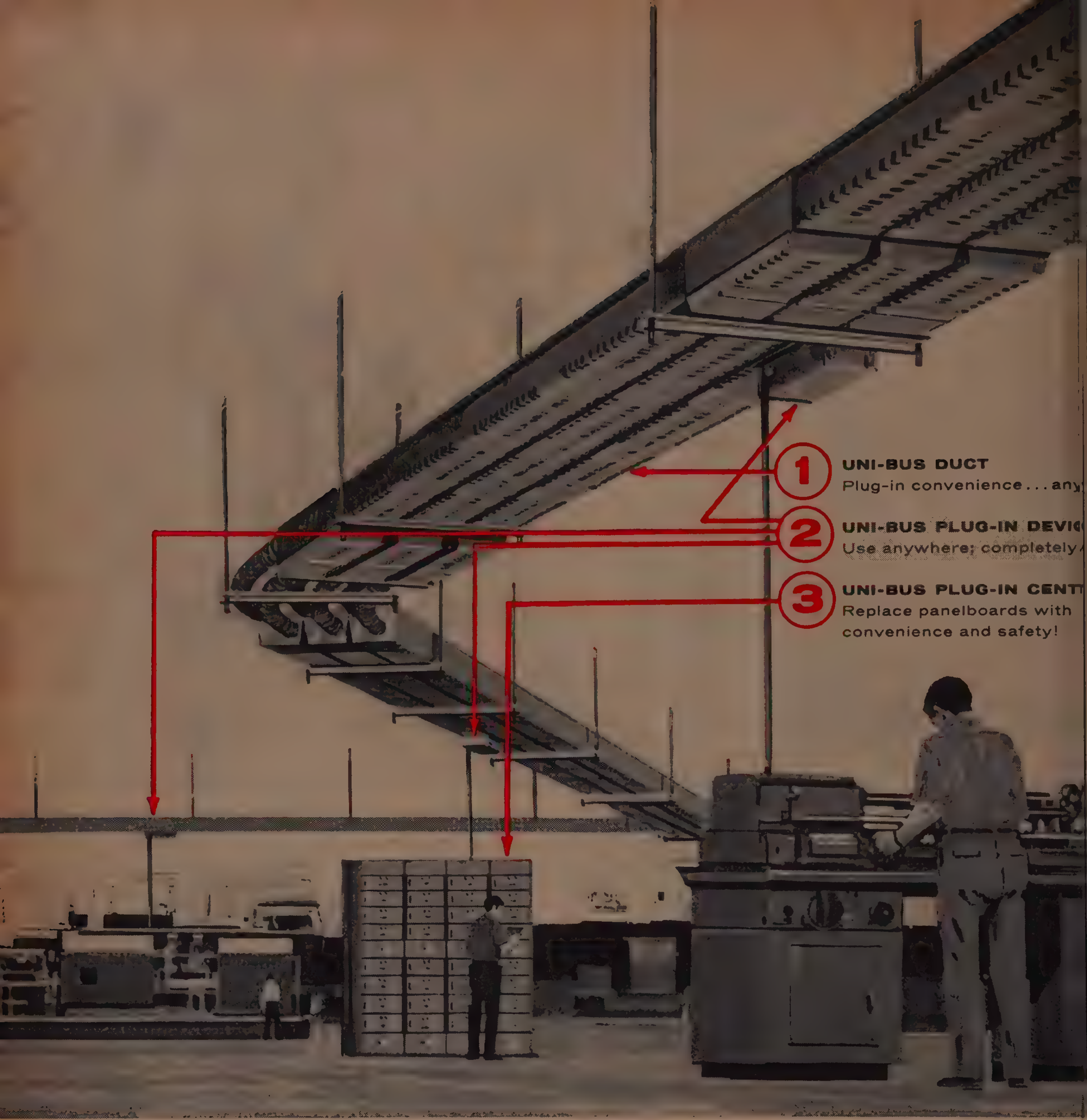
Order from your Killark distributor. He has the item you need in stock for immediate delivery. If not, he can get it promptly from a nearby Killark warehouse. There are 18 of these dependable supply sources located throughout the United States and Canada.

Killark

ELECTRIC MANUFACTURING COMPANY
Vandeventer and Easton Ave. • St. Louis 13, Missouri

In Canada: Killark Electric of Canada, Ltd., 421 Islington Ave. South, Toronto 18, Ont.

6118



UNI-BUS DUCT
Plug-in convenience . . . any

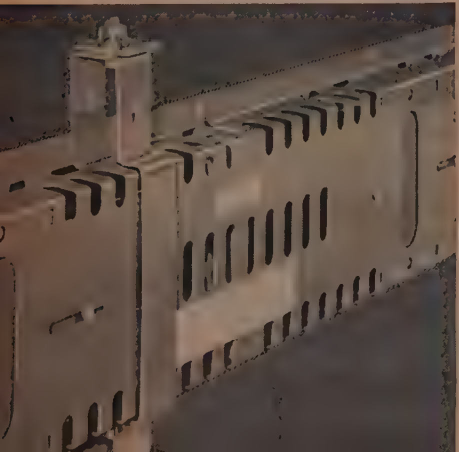
UNI-BUS PLUG-IN DEVIC
Use anywhere; completely

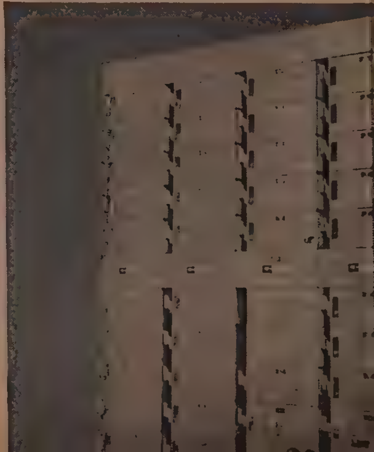
UNI-BUS PLUG-IN CENT
Replace panelboards with
convenience and safety!

1. HALF THE WEIGHT of most other ducts; selective low voltage drop; easier installation; easier maintenance . . . yet Uni-Bus costs no more! Family of six types for all industrial, commercial, laboratory and high rise building needs. Rated 100-4000 amps., 600 volts.

2. COMPLETE SAFETY, COMPLETE CONVENIENCE with Uni-Bus Plug-in devices which provide branch circuits at every 10 inches of Uni-Bus duct . . . or in stacks in the new Uni-Bus plug-in distribution centers. Patented interlocks make it impossible to touch a live part!

3. PLUG-IN POWER for distrib
motor control, and lighting panels i
vided by new, flexible Uni-Bus P
centers. Plug-in Trof design takes
less space; provides groupings of 2
locked plug-in outlets in 20 inch
enclosures.





CONTROL

A new approach to in-plant power

Uni-Bus makes your entire distribution system a plug-in switchboard!

Get low voltage drop, easy installation, the ultimate in flexibility, safety and power availability...yet you pay no more!

Here's an entirely new kind of distribution system that provides all you need in accessible and flexible circuit protection right from the main disconnect to the ultimate use!

It's so safe you can't touch a live part anywhere in the system . . . so convenient you can plug in any place, any time . . . so lightweight and easy to assemble you can cut installation and maintenance time drastically.

That's not all! Better design gives better electrical performance . . . low voltage drop; no derating regardless of mounting plane.

Uni-Bus is so flexible you can revise it readily even if your plant layout changes every year. No obsolescence . . . duct, plug-ins and fittings are 100% reuseable.

Look at this list of Uni-Bus features. Don't you see a *better* answer to *your* power distribution problems?

Standard Components—Uni-Bus is a complete system featuring interchangeable parts all the way. Uni-Bus requires less than ¼ of the accessories of ordinary busway.

No Specials—Off-the-shelf lengths mean you can tailor straight runs within 2½″. Exclusive flexible connectors take care of special turns and offsets.

Low Impedance—Ratings are increased through use of multiple bars scientifically spaced . . . specially insulated aluminum and copper bus bars are supported and air spaced by durable polyester glass insulators in ventilated steel enclosures.

Easy to work on—Complete safety not only protects life but also means worry-free, quicker work with less downtime for maintenance or alterations.

A system that grows—Plug-in centers grow with your needs. Plug in another standard device . . . or add another standard plug-in trof. No need to wait while somebody assembles and wires a new panelboard.

Next time you build, remodel, or expand a plant get the busway system that gives you so much more. Choose Uni-Bus . . . the complete power distribution system with complete plug-in safety, convenience, and economy.

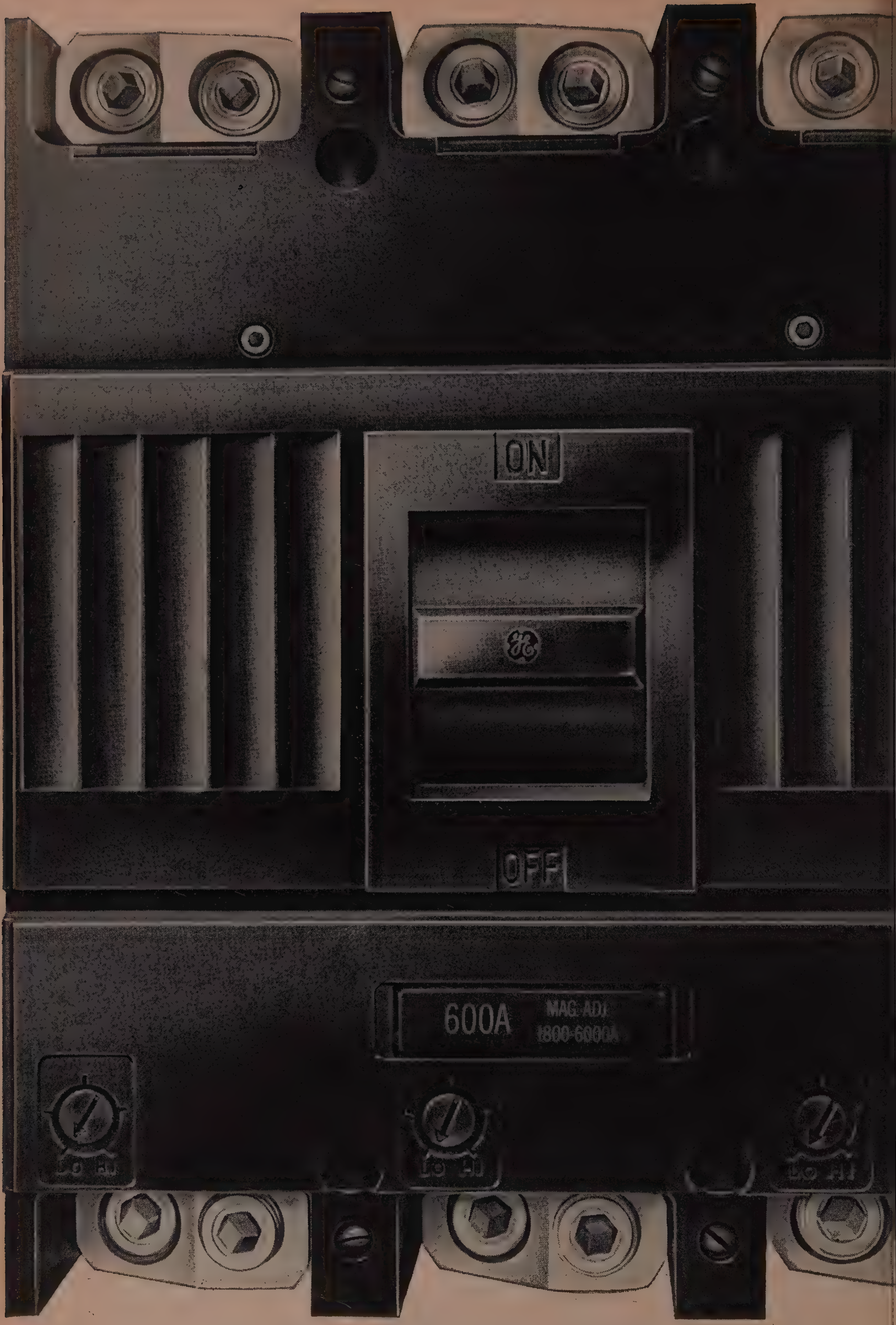
See your Cutler-Hammer distributor or representative today! Or write direct for Publ. LU-23-W241, on Uni-Bus duct systems and plug-in distribution centers.

WHAT'S NEW? ASK...

CUTLER-HAMMER

CONTROL

Cutler-Hammer, Inc., Milwaukee, Wisconsin • Divisions: AIL; Mullenbach • Subsidiaries: Uni-Bus, Inc., Cutler-Hammer International, C.A. • Associates: Cutler-Hammer, Canada, Ltd.: Cutler-Hammer, Mexicana, S.A.


ON
OFF
600A
MAG ADJ
1800-6000A
LO HI
LO HI
LO HI

THE ACTUAL SIZE OF GENERAL ELECTRIC'S NEW 600 AMPERE CIRCUIT BREAKER!

The J-600 line is the smallest molded case circuit breaker to be rated at 600 amperes, 600 volts. Measuring 8¼ in. w x 10⅛ in. h x $4\frac{1}{16}$ in. d, it's even smaller than most other 400 ampere breakers.

This is what this development means: The J-600 can be put into existing panelboards and enclosures; only minor design modifications are needed since the J-600 is the same size as General Electric's previous J-400 circuit breaker. And with GE, you still need only four frame sizes to cover every need from 15 to 1000 amperes.

Accent on VALUE

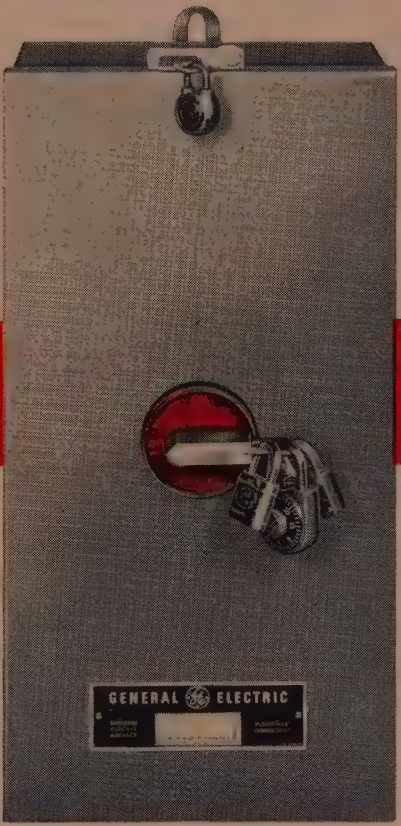
The J-600 features ambient compensation up to 50°C, eliminating the need for complex derating. The magnetic trip is adjustable with ±10 percent accuracy at all settings. Trip units are interchangeable. A complete selection of matching enclosures is available.

Write for the full story on the new J-600 circuit breaker — now in stock—rated 125 to 600 amperes, 240, 480 and 600 volts. It's fully tested and proved for your use. *Circuit Protective Devices Dept., Plainville, Conn.*

GENERAL ELECTRIC

NOW AVAILABLE

A NEW complet
for all General Electri

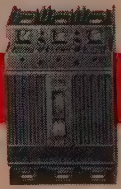


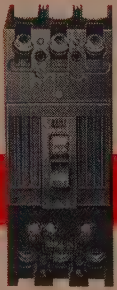
NEW NEMA 1, 1A (E 100, F 225, J 400) — Plenty of knockouts. Convenient key hole mounting. External rotary-operating handle mechanism. Provision for up to three padlocks for extra safety. Handle interlocks with cover. Easy wiring with removable cover and handle. Trip indicating. Oil and dust resistant.

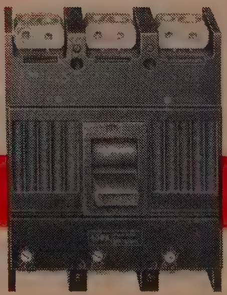
***FEATURING:* NEW NEMA 12 . . . without knockouts** — Fully conforms to all NEMA 12 and Joint Industry Conference standards. External mounting feet. Oil-tight and dust-tight. Removable hinged covers for easy wiring. Hinged rotary-operating mechanism. Handle interlocks with cover. Door cannot be opened with breaker ON. Provisions for multiple padlocking. The K 1000 Line, NEMA 12 can be wired with incoming lines at Top or Bottom, can save you up to $100 on cable cost alone.

SIMPLE TO SELECT . . . JUST FOUR BASIC FRAME SIZES FROM 15 TO 1000 AMPERES

and *all* available in conventional, Hi-Break*, Vu-Break*, Magnetic only and non-automatic models.
(*Trade Mark of General Electric Company
Illustrations are not to scale)


E 100 — 15 to 100 amperes; 240, 480 volts

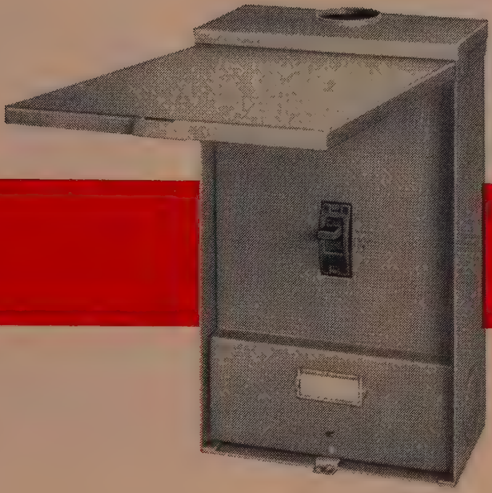

F 225 — 70 to 225 amperes; 240, 480, 600 volts


J 400 — 125 to 400 amperes; 240, 480, 600 volts

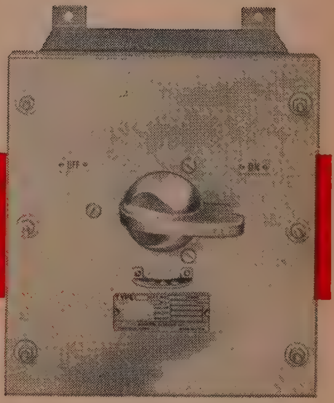
K 1000 — 125 to 1000
peres; 240, 480, 600 vol

ine of enclosures ircuit breakers

MA 1 . . . handle-thru-cover — Cover ut gives direct access to breaker handle, indication. When tripped, handle moves id-position between ON and OFF. Plenty nockouts for easy wiring. Locking shelf front for personnel safety. Available for or surface installation.



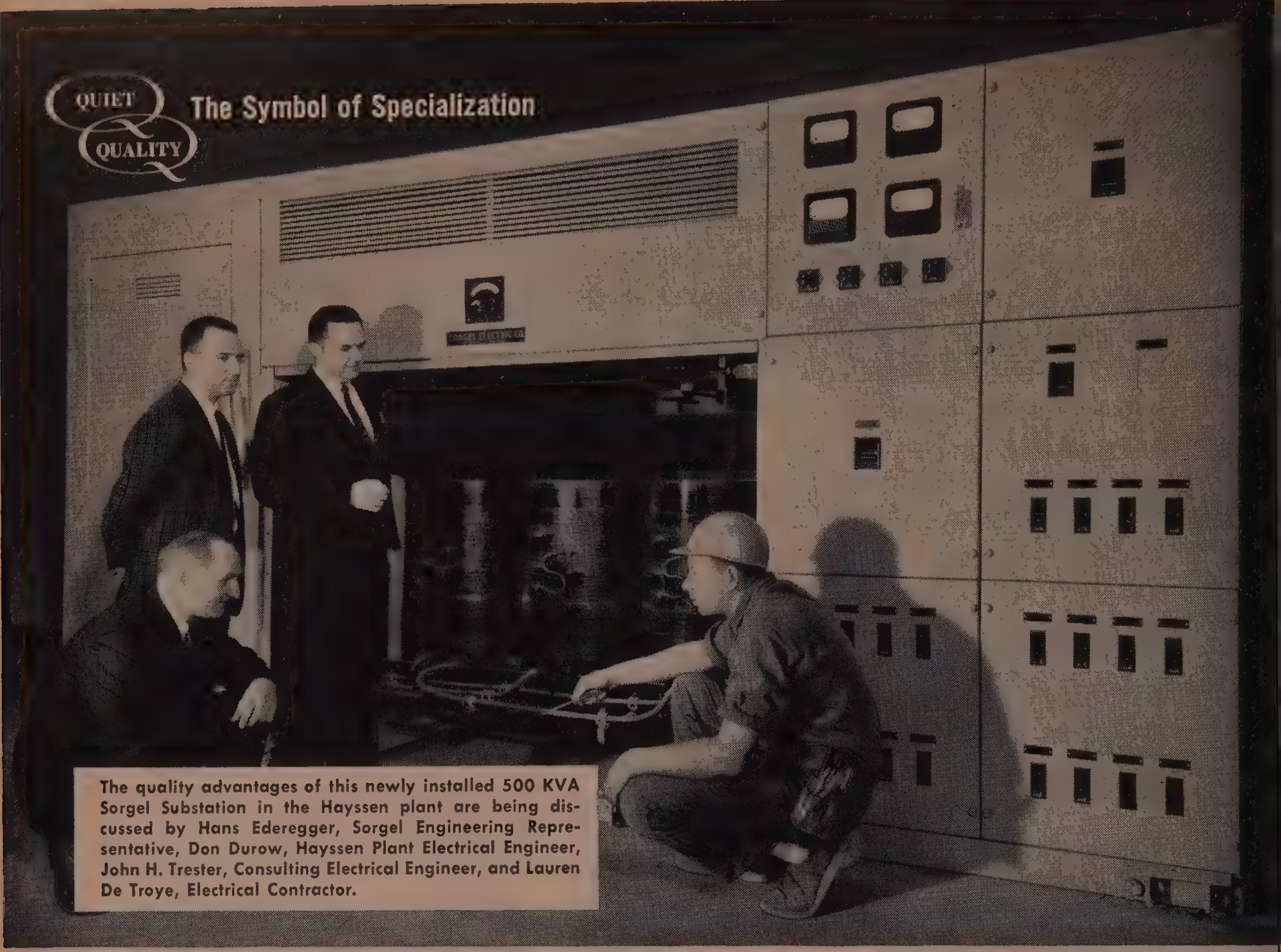
NEMA 3R . . . raintight — Available with provisions for inter-changeable raintight hubs, from 1 to 2½" diameter (E 100, F 225). Also available with blank end walls for use with Myers-type hubs from 2½ to 4" diameter. Drip-tight, moisture resistant. Top-hinged cover removed easily.



NEMA 4, 5 . . . Water and dust-tight. Available in *either* stainless steel or cast iron. High-nickel stainless steel used throughout — even for mounting brackets. Cast iron enclosure offers wing nuts to facilitate clamping cover tightly against neoprene rubber gasket and enclosure.

Designed for use with the new G-E line of molded case circuit breakers with space savings up to 70%. Only four basic frame sizes cover every need from 15 to 1000 amperes. Simple to select. Simple to apply. Versatile. Compact. Specify General Electric circuit breakers and enclosures for your next installation. Now in stock at your nearest General Electric Distributor or write Circuit Protective Devices Department, Plainville, Connecticut.

GENERAL ELECTRIC



The quality advantages of this newly installed 500 KVA Sorgel Substation in the Hayssen plant are being discussed by Hans Ederegger, Sorgel Engineering Representative, Don Durow, Hayssen Plant Electrical Engineer, John H. Trester, Consulting Electrical Engineer, and Lauren De Troye, Electrical Contractor.

ANOTHER EXPERIENCED ELECTRICAL TEAM SPECIFIES AND BUYS SORGEL

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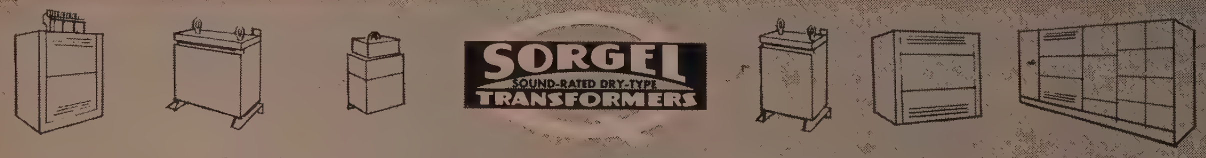

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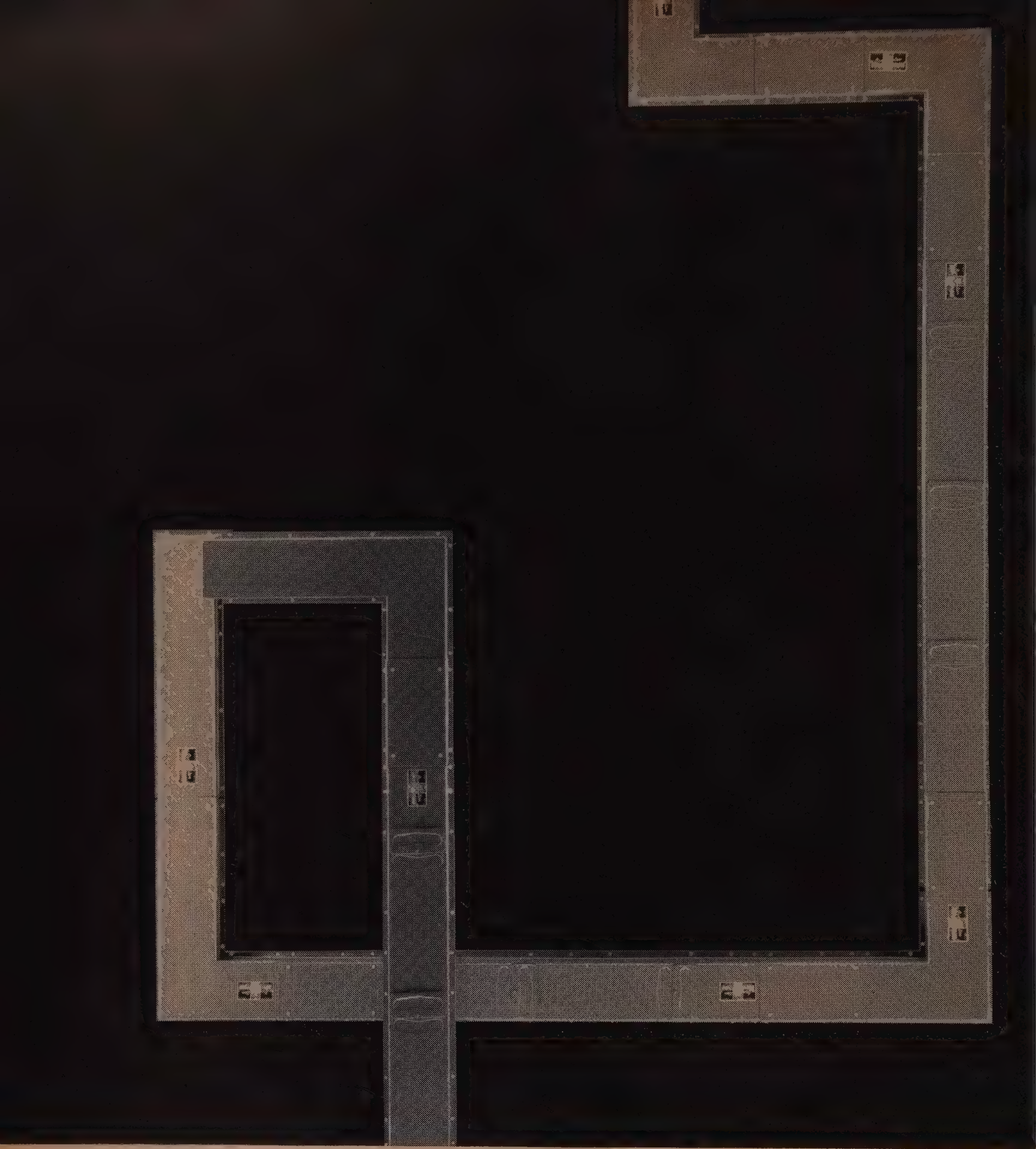

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62ND YEAR • NOVEMBER 1962

ELECTRICAL CONSTRUCTION AND MAINTENANCE

Contractors and the Code

At the convention of the National Electrical Contractors Association in Minneapolis last month, it was reported that a major program of code training for electrical contractors will be launched early next year. Courses will be conducted by NECA Chapters. The discussions, it is expected, will not only improve understanding but will ultimately lead to a more active role by electrical contractors in code development.

The project could not be more timely. The 1962 revisions of the NEC are extensive. With each edition the code becomes more elaborate and more complex as it reflects advances in electrical technology and product developments. Yet a confident understanding of the code is vital to the electrical contractor because, on most jobs, he and he alone bears full responsibility for compliance with applicable codes, standards, rules and ordinances.

The ability to appraise code requirements in terms of practical design, hardware and workmanship is a significant area of the electrical contractor's specialized competence. It is part of the expert services he performs. It is part of his responsibility to his customers and to the public. Thus, of all the "interests" directly or indirectly affected by the code, those of the electrical contractor are paramount.

Traditionally, however, the electrical contractor accepts the code uncritically and works out problems that arise directly with his inspector on the job. While this procedure is eminently practical and realistic, it denies to the industry the insight and experienced wisdom that often go into these isolated, day-by-day discussions, solutions and decisions.

Many contractors, too, tend to look upon the code as a remote institution conducted by "authorities." Few are sufficiently familiar with code-making procedures to realize that constructive recommendations are regularly processed through orderly channels available to any qualified person.

The NECA code discussions are bound to benefit those participating. More confident knowledge of the code naturally results in more harmonious relations with inspection authorities. Valid complaints can also be translated into constructive action as contractors learn how to place their proposals and viewpoints effectively before code-making bodies. Electrical contractors have much to contribute to code development. Their more active participation in code matters should be encouraged and welcomed by everyone concerned with electrical safety.

Wm. T. Stuart

of the building interior required various lengths of up and down conduit home runs from apartments to meter closets.

2. The use of a single feeder riser for each vertical half of the building offered substantial economy by permitting sizing of the riser conductors on the basis of high load diversity. If two or more feeders were used to divide the load of meter-distribution centers, the sum of the carrying capacities of the several feeders would have had to be considerably greater than the carrying capacity of the single feeder circuit.

This is pointed up even in the NE Code, Table 220-4 (a), which gives minimum feeder demand capacities based on given demand factors. For instance, if a load of, say, 246,000 watts of branch-circuit load was divided among three feeders, each feeder would have to supply 82,000 watts. The demand capacity of each would have to be 3000 watts @ 100% plus 79,000 watts @ 35%—or *30,650 watts.* But if the total load were served by a single feeder, its capacity would only have to be 3000 watts @ 100% plus 117,000 watts @ 35% plus 126,000 watts @ 25% —or *75,450 watts.* Thus, the capacity of the single feeder is much less than the sum of the capacities (91,950) of three feeders dividing the total load.

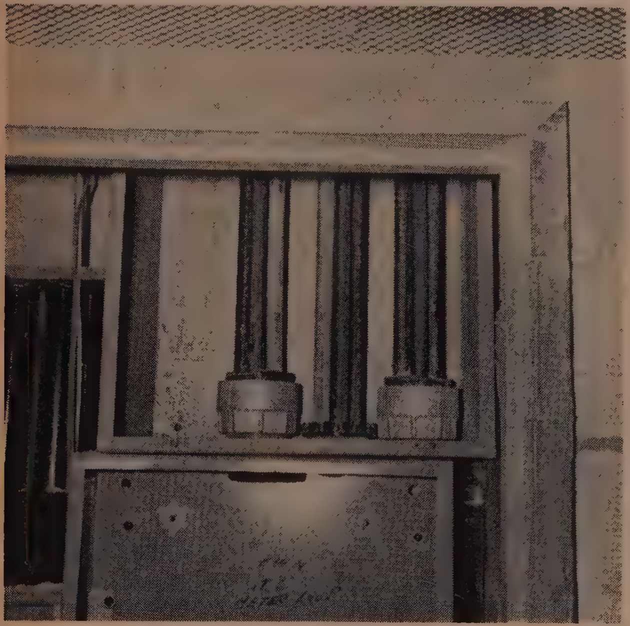
Of course, with the multiple feeder layout, each feeder riser could be terminated vertically where it fed its part of the total load, instead of being carried all the way to the top of the building, as with the single feeder riser.

3. Another advantage of the single riser layout is the need for only two riser overcurrent and control devices in the basement switchboard. If more risers had been used, a larger number of overcurrent devices would have been required in the switchboard.

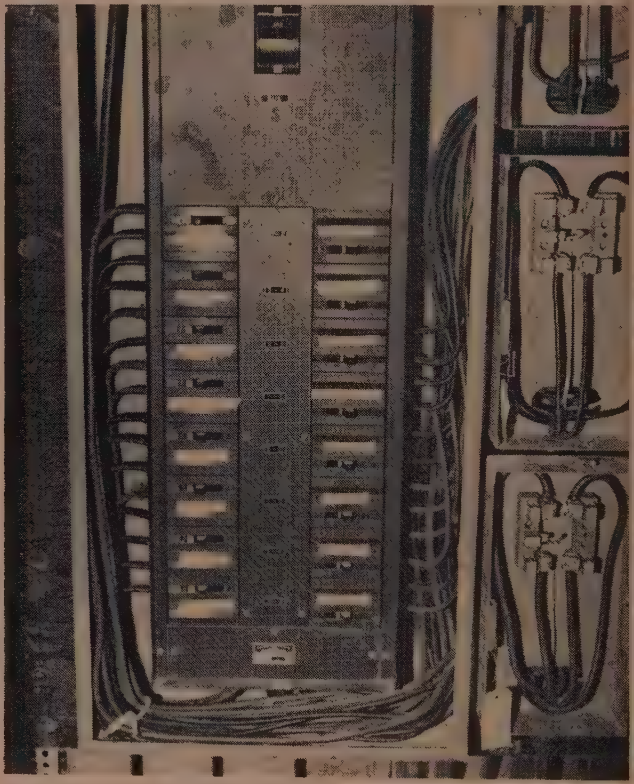
4. Along each of the two risers supplying the building, six meter-distribution centers are tapped to supply subfeeders to each apartment, with the sizes and layouts of these subfeeds varying with the sizes and locations of apartment units. The six meter centers along each riser supply apartments on 13 floors and roof penthouse apartments.

A variety of job details—both design and construction—are shown in accompanying illustrations.

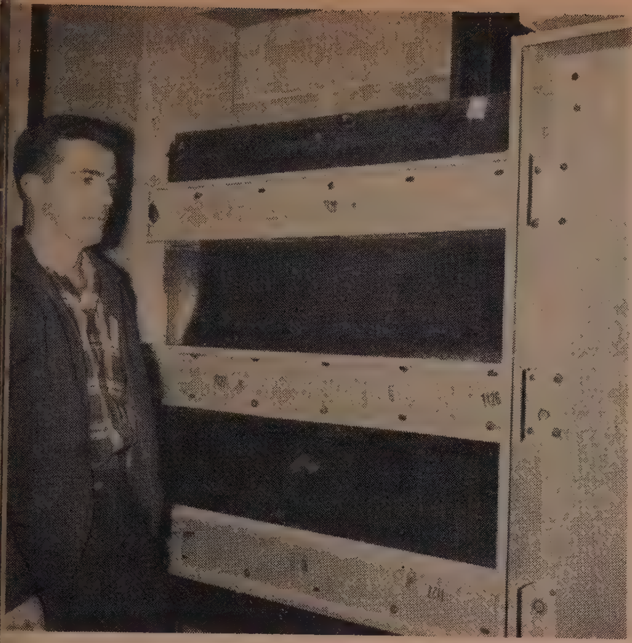
METER CLOSETS



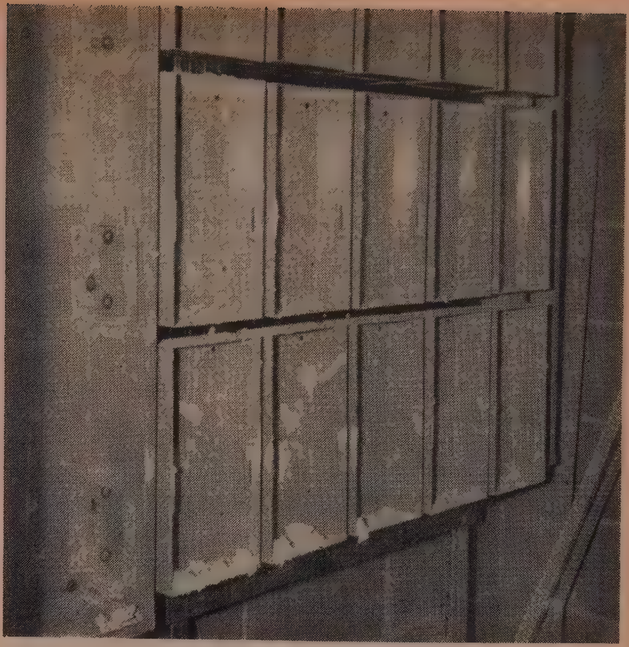
RISER CONDUCTORS, three sets of four 500 MCMs in 3½-in. conduit are shown in a pullbox at a typical meter-distribution center for apartments. The aluminum riser conduits connect to the bottom and top of the pullbox. The riser conduits are here obscured by the enclosure (bottom of photo) for the distribution panelboard. Note the use of cable support bushings on two of the 3½-in. risers. The middle circuit is supported at the next higher and lower pullbox locations. Close spacing of conduits prevented use of three such support bushings at one pullbox location. Staggered vertical spacing of the cable supports still provides support within the 40 ft maximum spacing set by the NE Code for 500 MCM cables. The utility required an approved cover for sealing the pullboxes which contain unmetered tap off points.



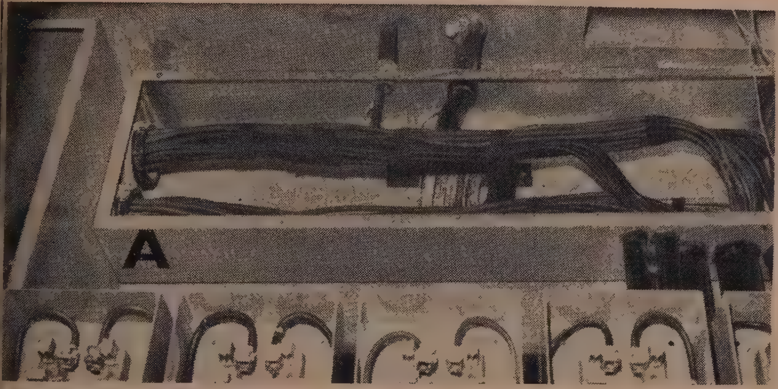
DISTRIBUTION PANELBOARD at each meter closet has a 225-amp, J-Frame molded-case circuit-breaker main fed from taps to the multiple-conductor riser. The three 3½-in. riser conduits can be seen at bottom left. A total of 16 2-pole, E-frame molded-case breakers are in the panel. Each of 15 breakers serves as control and protection for one apartment subfeed. One CB is a spare. Ratings of apartment subfeeds vary due to variation in size of apartments. Some subfeeds are No. 8; some, No. 6; and some, No. 4. Breakers are rated, correspondingly, at 40 amp, 50 amp, and 70 amp. Each apartment is supplied at 120/208 volts, 3-wire—two phases and a neutral from the 120/208-volt, 3-phase, 4-wire distribution system.

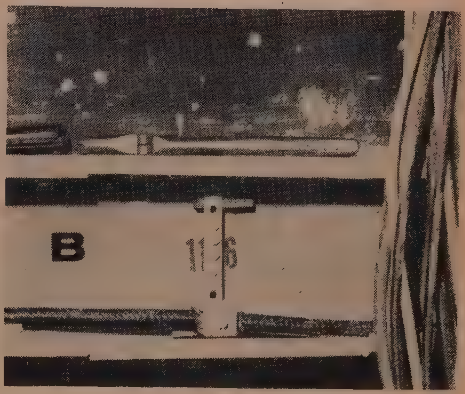


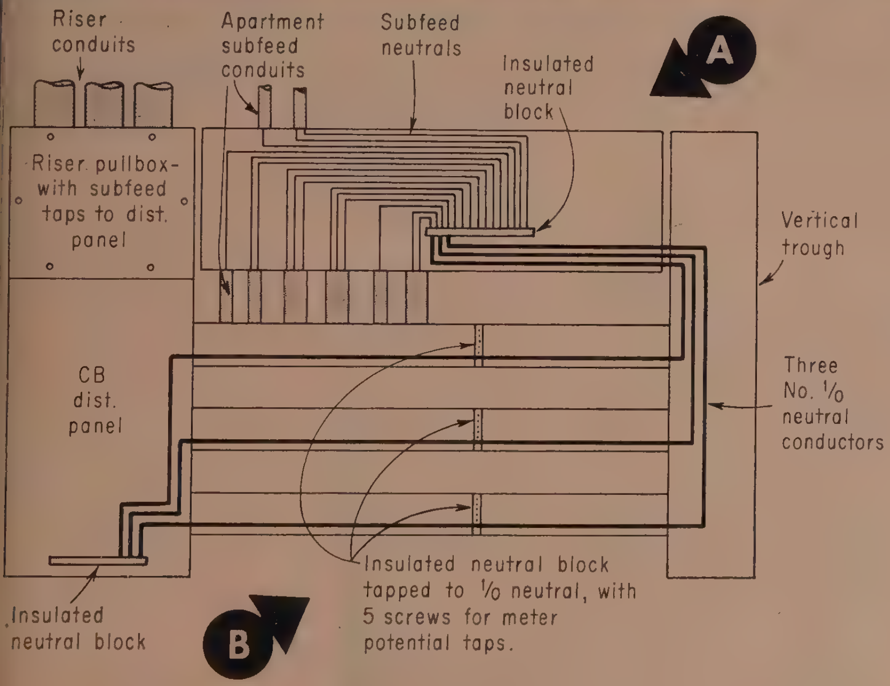
TWO STAGES in assembly of meter closet are shown here. n photo at left, gutters for meter wiring extend from distribution panel at right to trough at left (in some closets, panel s on right side of assembly, in others it is on the left side).



Dick Griffin, foreman for Cucinell Electric, is inspecting the gutters which are chase-nippled to the vertical trough. In photo at right, meter enclosures are installed over the wiring gutters. There are three horizontal rows of five meters each.





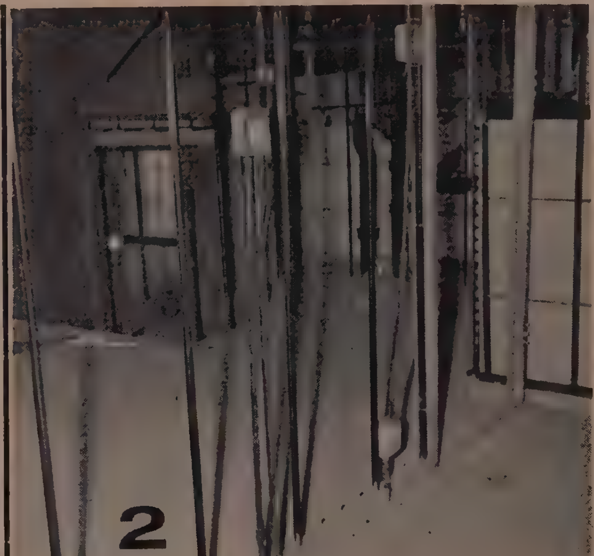


Riser conduits
Apartment subfeed conduits
Subfeed neutrals
Insulated neutral block
A
Riser pullbox-with subfeed taps to dist. panel
Vertical trough
CB dist. panel
Three No. 1/0 neutral conductors
Insulated neutral block tapped to 1/0 neutral, with 5 screws for meter potential taps.
Insulated neutral block
B

NEUTRAL ARRANGEMENT is shown in the diagram. Detail "A" is shown in photo of typical gutter above meter layout (photo is at meter closet with position of panel and vertical trough opposite to that in diagram). Neutral block is visible in gutter. Detail "B" is shown in closeup photo of neutral block for making potential taps to meter terminals.

WORK DETAILS were many and varied at assembly of mete closets At left, "bullcutters" quickly cut the lengths of 1/C for neutrals through the meter gutters. At right, one cable end is being skinned for insertion in neutral block of gutte above meters (detail "A" in diagram of meter closet layou shown on page 77).

APARTMENTS



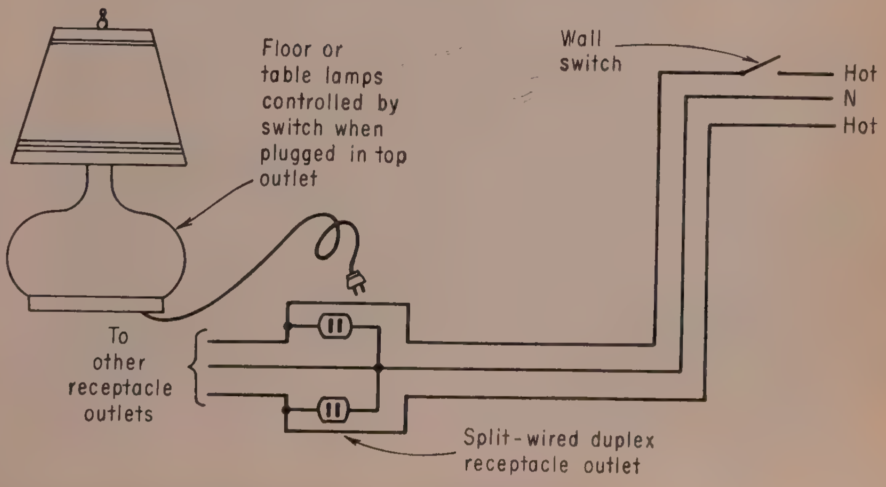
2

THIN PARTITION walls in apartments limited branch-circuit conduit to maximum of ½-in. size. Two-in. thickness of all-plaster walls made placing and aligning of conduit critical tasks. And to accommodate the number of wires involved in the circuit work in such thin walls, outlet boxes are shallow type—4 in. square, 1¼ in. deep. Note that all branch-circuit conduits, as well as all apartment subfeeder conduits, are black enamel conduit. Use of black enamel conduit offered economy in material use, while providing all of the advantages of rigid conduit. Up to 2-in. size black enamel was used. Series of photos here show sequence of wall construction in typical apartment kitchens: (L-R) 1. extension of conduit stub-ups from slab and installed boxes (note split-level background); 2. frames set for wire lath; 3. scratch plaster undercoating going on; and 4. finished plaster wall. Photos 1 and 2 show a kitchen on one side of the apartment. Photos 3 and 4 show the same electrical layout in an apartment with the kitchen on the other side.

4

APARTMENT PANELBOARD is installed in the kitchen of each apartment. They are mounted rather high to make them inaccessible to children. At left, enclosures and conduit are shown for intercom unit to building lobby and for apartment branch-circuit panelboard. In center photo, closeup shows later stage of construction. Apartment branch circuits, subfeed to this panel and a feed-through to another apartment panelboard are shown pulled into the panel enclosure. Photo at right shows CB panel installed in enclosure. Number of circuits in panel varies with the size of the apartment.

KITCHEN CIRCUITS are shown at left feeding an outlet box to supply a sink disposal unit and a built-in dishwasher. A 3-wire home run is made in the ½-in. black enamel conduit coming up to the box from the floor. Armored cable is used to feed the two appliances. And, as shown at right above the countertop, a duplex, grounding-type, convenience receptacle is installed in the box, connected on the 120-volt side of the circuit with the disposal unit. The switch on the outlet controls the disposal unit. A total of four 20-amp circuits provide high-capacity for appliances in kitchen and dining area.


Floor or table lamps controlled by switch when plugged in top outlet
Wall switch
Hot
N
Hot
To other receptacle outlets
Split-wired duplex receptacle outlet

SPLIT-WIRED RECEPTACLES in living room and bedrooms of each apartment provide for switch control of the top outlet at each duplex receptacle in these areas.

DODGER STADIUM in Los Angeles seats 56,600 spectators; has total connected electric load of 6000-kva provided through 11 substations. This past season 120 games were played under lights; nearly 3 million fans attending night games. Lighting and electrical systems were enginee by J. S. Hamel; installed by C. B. Drauker.

Los Angeles Stadium Uses

New Floodlighting

Using a new lamp in a new reflector, Dodger Stadium in Los Angeles obtai 260 footcandles on the infield. High efficiency fixtures are operated at norm voltage, resulting in lamp life of 1500 hours.

By J. S. Hamel, *Consulting Electrical and Mechanical Engineer, Los Angeles, Calif.*

AT THE new 56,600-seat baseball stadium in Los Angeles, a major feature is a modern high intensity lighting system. The stadium facilities are shared by the National League Dodgers and the American League Angels. Nearly 75% of both teams' home schedules are played under lights and these games account for 80% of the season's attendance. Consequently, the quality of the lighting and of the lighting system performance are of unusual importance to the fans and to the management.

The writer designed a new floodlight reflector to hold a new 1200-watt incandescent reflector lamp, then mounted 1584 fixtures on eight 172-ft towers, thereby obtaining intensities averaging 260 fc on the infield and 170 on the outfield.

The installation provides excellent visibility for fans and players alike. Shadows and glare are negligible. And, by burning lamps at rated voltage, rather than at the formerly advocated level of "plus 10%," normal lamp life of 1500 hours is possible and group relamping is required only every seco year.

This direct reversal of the ov voltage concept has been more th justified by increased lumen outp from the new lamp-reflector co bination. It also has been justif economically, because, by obta ing rated life at standard volta power consumptions and lamp placement charges have been duced. In this installation t lighting load on the eight tow amounts to 1901-kw. The util charge is $19.01 per hr. Also on

MOUNTING AND SHIELDING of floodlights either removes completely or minimizes direct glare from normal angles of sight of players and spectators alike. Average projected distance of light beams, from fixtures to points of impingement on field, is 330 ft. The maximum beam candlepower is approximately 300,000.

Design

hourly basis (including labor and lamp costs for a bi-annual group relamping schedule), replacement costs amount to $15.99 per hour. This operating-replacement total of $35 per hour, or less than $200 per night, appears extremely modest when related to average attendances of 30,000 per game.

Basic light source in this installation is an incandescent R-80 120-volt lamp, mounted in a specially designed reflector which increases utilization of available light and provides exceptional glare control.

The lamp is of hard glass, designed for outdoor use, measuring approximately 10 in. in dia, weighing 1½ lbs and having a medium beam spread of 21 degrees.

This 1200-watt lamp is contained in a Shalda 650 floodlight fixture, weighing 16½ lbs and including an external Alzak reflecting cone to redirect light rays in slightly diverging beams along the principal axis. The result is nearly a 25% boost in

CANTILEVER CONSTRUCTION of upper grandstand roof permits support of light towers without extending structural members down to more massive footings below. This provides completely unobstructed view of field from all seats. Lights, spaced 3-ft vertically and 2-ft horizontally, are relamped and maintained from catwalks.

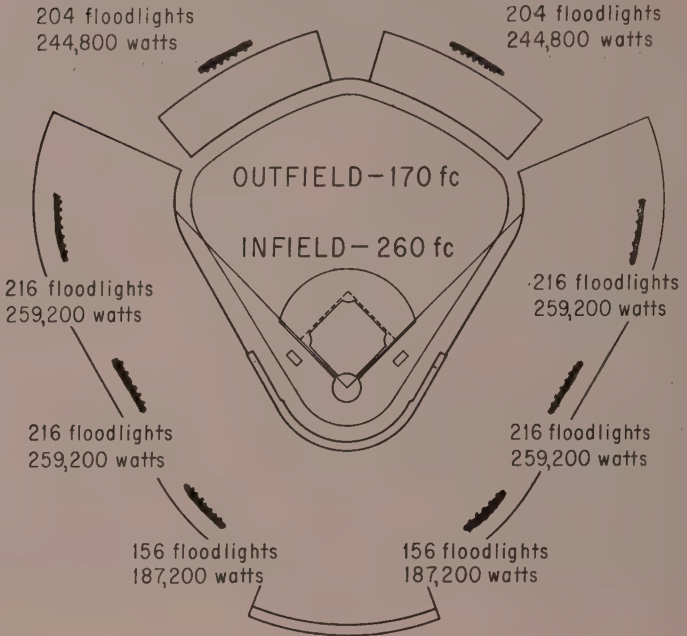
beam lumens, compared to a standard reflector lamp without outer cone. With this new combination, beam candlepower of each lamp is increased from a normal rating of 240,000 to approximately 300,000. And, as indicated by plotted Candlepower Curve, light is concentrated within a 6-degree high-intensity beam spread. Another feature of the floodlight is its deep construction, which provides a sharp cut-off angle and constitutes an effective shield against glare. Lamp filaments can be seen only when lines of sight are within 25 degrees of fixture axis, and extensive analysis of normal viewing angles indicates that this cut-off angle is effective for players as well as spectators.

When viewed from angles outside of the direct cone, fixture brightness varies from 50 ft-Lamberts down to 28.

To illustrate, towers are positioned so that no floodlights are directly behind home plate or center field, or at the end of either foul line, or in line with basepaths between 1st, 2nd and 3rd bases. This means that players in normal positions, following normal trajectories of the ball, are not likely to look directly into a glare cone. It will be noted that floodlight towers are in the line of sight of players looking towards home plate from either foul line. This is not serious, however, since beam projections are confined within a 30- to 40-degree angle of incidence, while fly balls are generally above this angle and infield throws are below it.

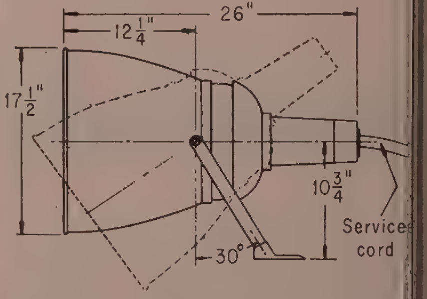
Tower placements and heights were dictated by five considerations: player safety, spectator enjoyment, architectural esthetics, structural problems and economics. These factors resulted in locating towers and shielding lamps as noted above. They also dictated a tower height limit of 172 ft, with placement on grandstand shelter roofs so that shadowless illumination would be provided for the entire field, not only the playing area. Higher towers would have permitted beam projections having angles of incidence greater than the 30 to 40 range obtained, although higher towers also would have posed such additional problems as heavier structural foundations, obstructions in front of rear-seat spectators and shadow impingement of roof lips. The installation, bypassed these problems.

POLE LOCATION, NUMBER OF FIXTURES AND WATTAGE. AVERAGE FOOTCANDLE READINGS.



TOTAL of 1584 floodlights, mounted on eight towers, obtain 260 fc on infield; 170 on the outfield. Cost of floodlight power plus labor and lamps for bi-annual replacements amounts to $35 on an hours-of-use basis. Brightness values of fixtures, except within direct, narrow cones, are between 50 and 28 ft-Lamberts.

EXTERNAL REFLECTING CONE redirects light rays from R80 reflector lamp along principal axis of fixture, thereby obtaining 25% boost in maximum beam candlepower. Fixture is aimed by rotating calibrated, adjustable yoke and trunnions to desired azimuth and declination. Socket housing can be unlatched from external cone and removed to permit rear access for relamping and maintenance.



POSITION OF LAMP and deep constru tion of external reflecting cone provid effective cut-off angle against direct gla from filament. Weight of fixture a lamp, as installed, is 18 lbs; indicati that banks of lights approximate 2 to exclusive of mounting framework, towe or catwalks.

Largest concentrations of fixtures are on towers surmounting the side stands, where four banks of floodlights include six tiers of 36 lamps each, arranged geometrically with 3-ft vertical and 2-ft horizontal spacings. Fixture mounting yokes, bolted to horizontal angles of tower framework, may be swivelled horizontally through azimuths of 180 degrees. Trunions, supporting collars holding external reflecting cones, are similarly calibrated and adjustable within a 90-degree declination. Socket housings, secured to external cones by gaskets and toggle latches, are easi removable to permit rear access f relamping, cleaning and maint nance. Safety and convenience maintenance men is obtained guard-railed catwalks.

Aiming of floodlights was accon plished by means of a unique colo coded innovation. This involved t use of numerous colored aluminu discs which were placed on the fie in accordance with a precalculat pattern, while all floodlight hou ings were also color-coded to coi cide with desired beam directio Therefore, after erection of towe and lights, electricians on catwalks simply aimed color-coded lights at matching colored discs on the field. This was accomplished in daylight, then checked at night visually for glare and by meter for average intensities. Adjustments were minor and the result was a smooth blending of overlapping areas of light, accurate aiming, maximum effectiveness and minimum glare.

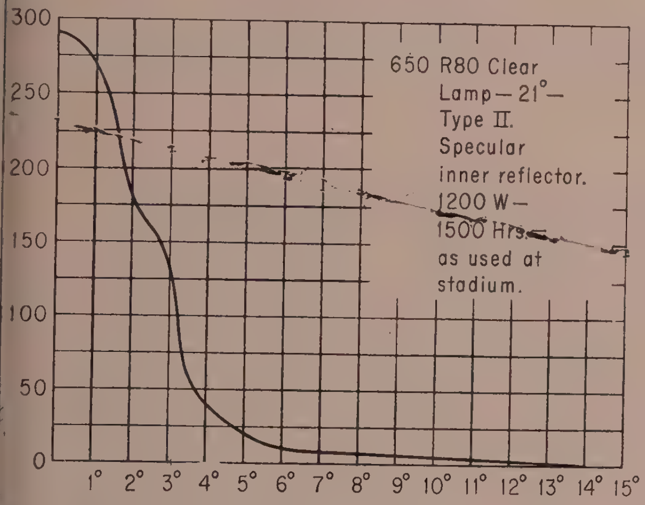
This installation establishes new standards for sports lighting, for coefficients of utilization are in the order of 75% on the vertical plane and 60% on the horizontal. Moreover, use of sealed reflector lamps insures full lumen output with each replacement, while optically designed outer glare cones obtain high lighting efficiencies, plus comfort for players and fans alike.

Although floodlighting is the largest single power component in the stadium, it is only a third of the total connected load of 6000 kva. The remainder of this load relates to elevators, concessions, restaurant and lounge areas, administrative offices, team and maintenance quarters, stands and parking areas.

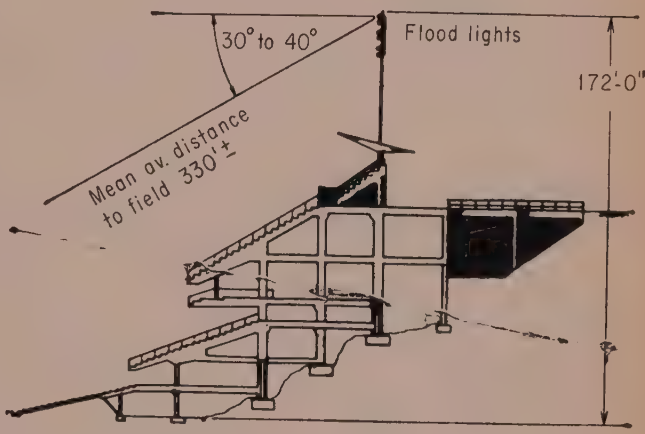
Primary power at 34½ kv is brought to the site through underground ducts, then transformed to 4160 volts at a utility substation and carried to high-voltage switchgear and metering equipment within the stadium. High-voltage main and distribution sections are switch and fuse assemblies, with four 4160-volt feeders serving eleven unit substations sized from 500 to 750 kva.

Control of playing field, seating section and parking area lighting is remote; the master panel being equipped with momentary contact pushbuttons and pilot lights. Pushbuttons activate motorized circuit breakers, each of which controls two or more feeder circuits. Complete lighting of the field is accomplished in five steps, with interlocks provided to insure proper sequence operation of pushbuttons and motorized breakers. Lighting of the stadium and scoreboard also is arranged for sequence operation.

The stadium was designed by Prager, Kavanaugh & Waterburn; built by the Vinell Construction Co.; electrically and mechanically engineered by J. S. Hamel; wired and lighted by C. D. Drauker, Inc., Los Angeles.

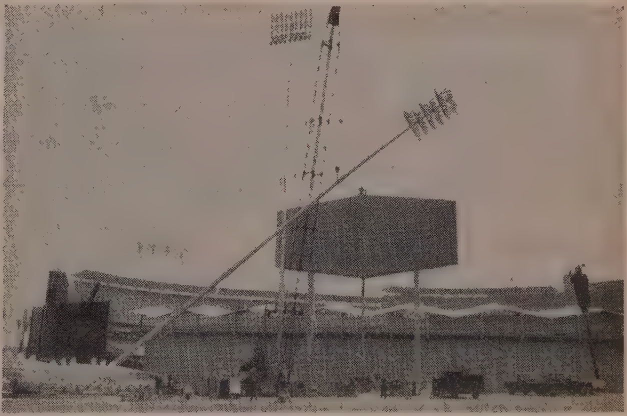


CANDLEPOWER CURVE of R80 incandescent clear-lens floodlight charts a maximum beam candlepower of 240,000 with a medium beam spread of 21 degrees. As indicated above, however, addition of specular inner reflector raises maximum beam candlepower to 300,000 and concentrates effective light output within 6 degree cone. By operating lamps at rated voltage, full life of 1500 hours is possible.



LIGHT TOWERS, mounted on shelter roofs over grandstand, illuminate entire field. Top rows of lights are 172 ft above playing area. Light beams project downward at 30-40 degrees from horizontal. Design of floodlight housing provides 25-degree cutoff for filament and concentrates beam within 6-degree high-intensity cone.

FLOODLIGHTS WERE SECURED to horizontal angles of tower framework and connected to tower panels prior to being raised into position as complete units. Color-coded fixtures were then aimed at correspondingly colored aluminum discs which were placed on the field in accordance with pre-calculated pattern.



HIGHEST MASTS, 172 ft overall, support two 204-light towers behind left and right fields. These towers consist of four masts each, hoisted into position with approximately 51 lights in each assembly. After erection, catwalks and cross members of adjacent sections were bolted to form unified structures.

Flexible Power For a Modular Industrial Complex

Flexibility and electrical capacity for the future are highlights of 18-unit, ½-million-sq-ft industrial plant designed for manufacturing, research and business. Series of substations obtain 4160-volt service through dual feeders in nine miles of underground ducts. 480-277-volt power is distributed via busway, underfloor ducts and square raceways. Electrical system, designed by Consultant Clair J. Bennett, was installed by Stetson Electric Co. in modular concept developed by T. Y. Lin.

A GROUP of industrial buildings with high-bay interiors free of columns or obstructions is under construction at Chatworth, Calif. Eighteen units or modules providing more than ½-million sq ft of floor space are built to uniform dimensions. They are coordinated to house the operations of the Whittaker Controls Division of Telecomputing Corporation, which, in addition to manufacturing space, require extensive office, laboratory, research and testing facilities. In view of the varied requirements and the owner's need for exceptional future flexibility in plant layout, the electrical system was planned to provide energy for any foreseeable use of the buildings.

As operations expand and departments are enlarged or reoriented, changes in layout will be needed and future electrical demands may well be much more than present requirements. Therefore, a multi-purpose, 120- by 240-ft module, with obstruction-free floor areas, was designed and power facilities sufficiently flexible to satisfy any conceivable use of the space was planned.

The consulting electrical engineer designed a 4160-volt dual-feeder underground distribution system. It carries service from an outdoor utility substation to a series of indoor substations. Each substation is equipped with a primary feeder-selecting switch, dry-type transformers and secondary switchgear.

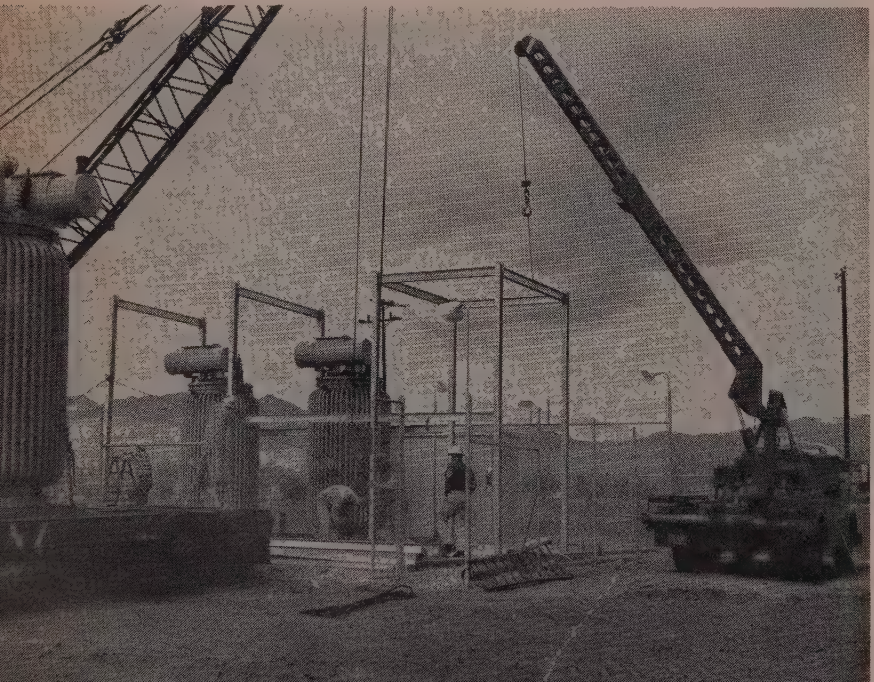
Primary switches are three-position, allowing connection to either of the two primary feeders, plus an "off" position.

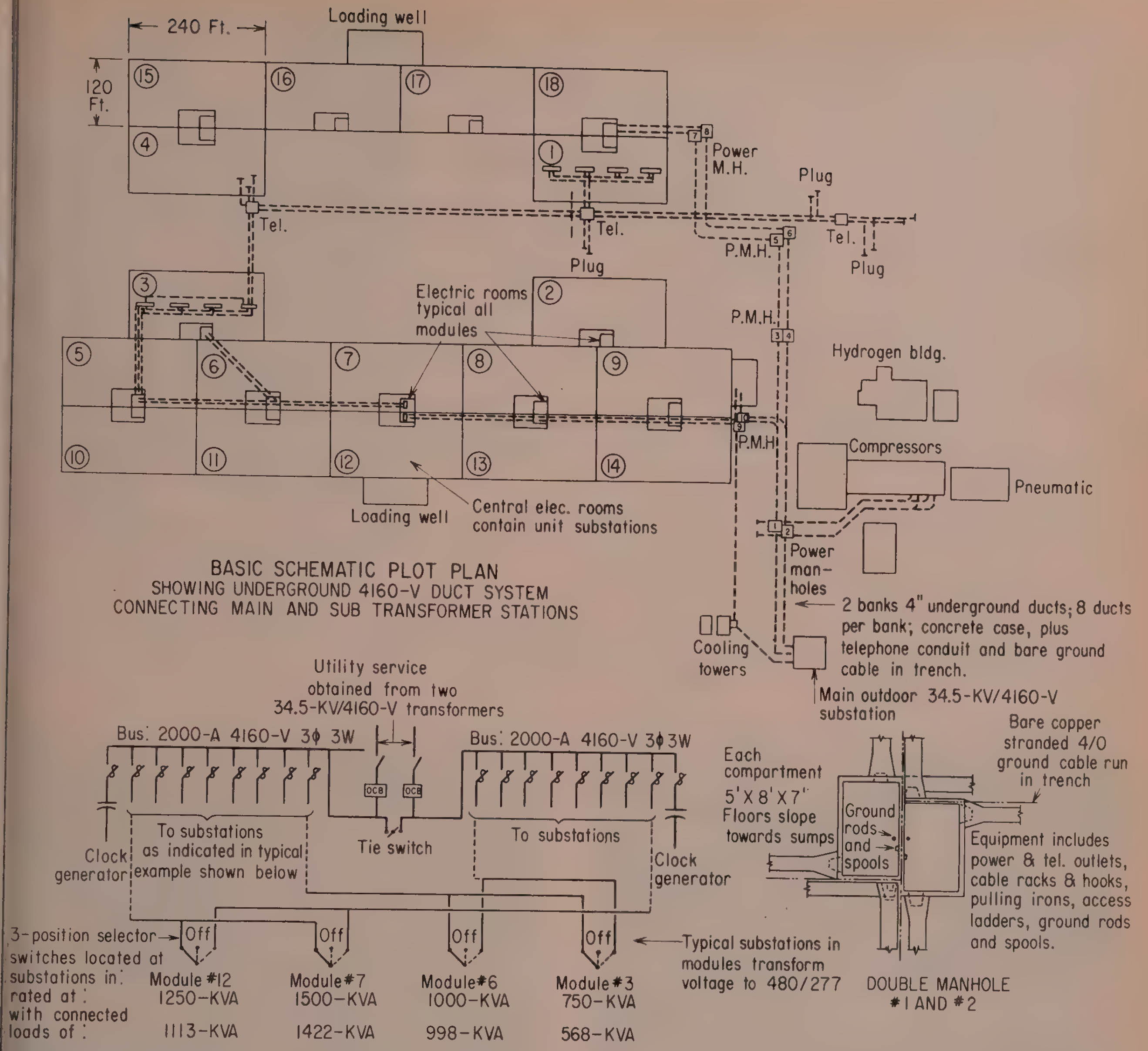
Secondary voltage is 480/277-volt wye.

As noted on an accompanying schematic plot plan, the 18 building modules will be concentrated into two groups. Electrical rooms are paired typically on opposite sides of common walls in order to simplify underground distribution ductwork and to permit centralization of equipment (such as air conditioning) serving adjacent buildings.

From these electrical rooms, underground secondary feeders radiate to distribution and power con-

TRANSFORMERS for 34.5/4.16-kv main substation total 10,000-kva capacity. Fenced enclosure also will contain 40-ft switchgear assembly housing bus structures, tie and feeder breakers, metering equipment and capacitors for clock system.

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Compressors
Pneumatic
⑩
⑪
⑫
⑬
⑭
Loading well
Central elec. rooms contain unit substations
Power man-holes
BASIC SCHEMATIC PLOT PLAN
SHOWING UNDERGROUND 4160-V DUCT SYSTEM
CONNECTING MAIN AND SUB TRANSFORMER STATIONS
2 banks 4" underground ducts; 8 ducts per bank; concrete case, plus telephone conduit and bare ground cable in trench.
Cooling towers
Main outdoor 34.5-KV/4160-V substation
Utility service obtained from two 34.5-KV/4160-V transformers
Bus: 2000-A 4160-V 3ϕ 3W
Bus: 2000-A 4160-V 3ϕ 3W
OCB
OCB
Tie switch
Clock generator
To substations as indicated in typical example shown below
To substations
Clock generator
Each compartment 5'X8'X7'
Floors slope towards sumps
Ground rods and spools
Bare copper stranded 4/0 ground cable run in trench
Equipment includes power & tel. outlets, cable racks & hooks, pulling irons, access ladders, ground rods and spools.
3-position selector switches located at substations in:
rated at:
with connected loads of:
Off
Off
Off
Off
Module #12
1250-KVA
1113-KVA
Module #7
1500-KVA
1422-KVA
Module #6
1000-KVA
998-KVA
Module #3
750-KVA
568-KVA
Typical substations in modules transform voltage to 480/277
DOUBLE MANHOLE #1 AND #2

SCHEMATIC of 4160-volt underground distribution indicates layout and wiring at outdoor and indoor substations, and details of double manholes.

trol centers. Subsequent distribution methods then vary in accordance with specific space use.

For example, in buildings devoted to offices, 3-cell underfloor ducts distribute 120/208-volt power, telephone wiring and intercom circuits on the first floor. Basement panels serve the power cells in this installation, 225-kva dry-type transformers supply power to these 120/208-volt panels from 480/277-volt substations.

Basement panels are enclosed in closets between columns supporting floor slabs. Underfloor ducts are maintained an inch below finished slabs *except* where cells periodically dip to cross under conduits, serving basement lighting, which are also enclosed in the slab. Triple-duct underfloor installations are metal, supported on 5-ft centers by saddles which were anchored to rough structural base slabs, prior to final pour, by means of powder-actuated stud drivers.

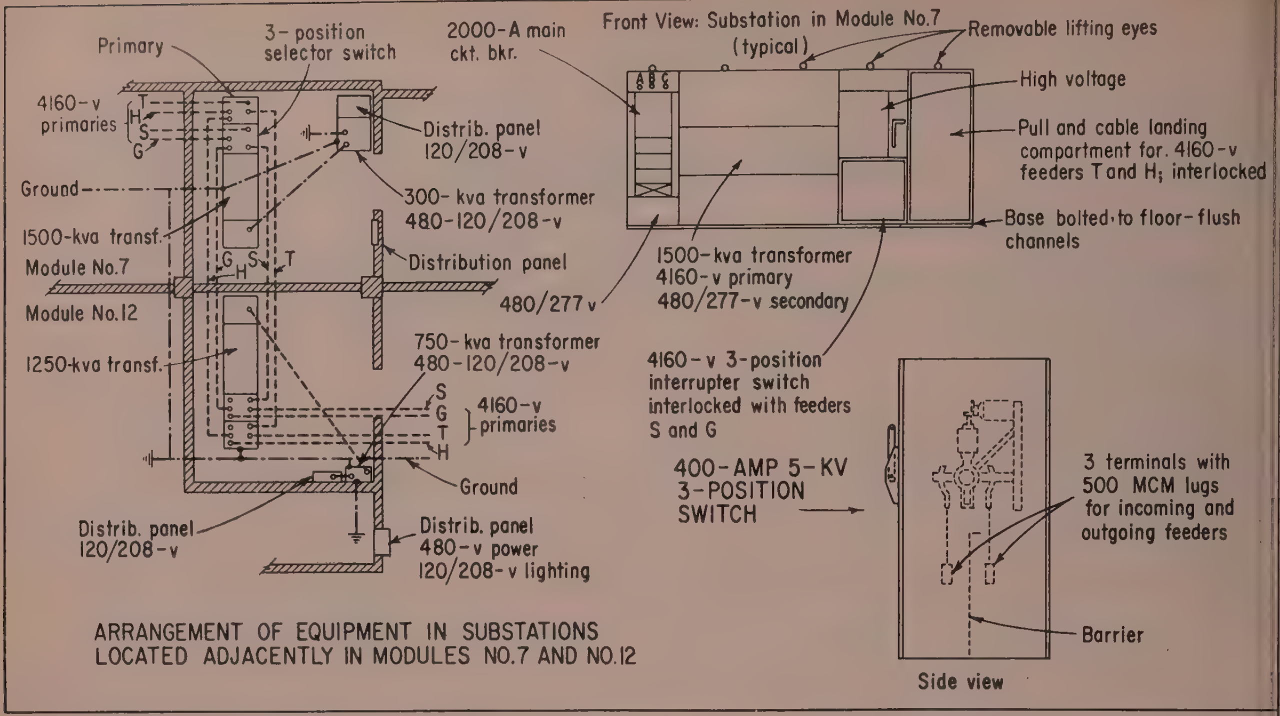
A different distribution system is found in manufacturing modules. Power for production is carried above work areas through plug-in busway. Bus plugs connect through EMT with floor-standing panels. Flex extensions connect floor panels with motorized equipment subject to vibration.

Another module presents still another modification due to the presence of an all-electric kitchen and cafeteria capable of serving 2200 people. There are also provisions for light-dimming and battery power for emergency lighting.

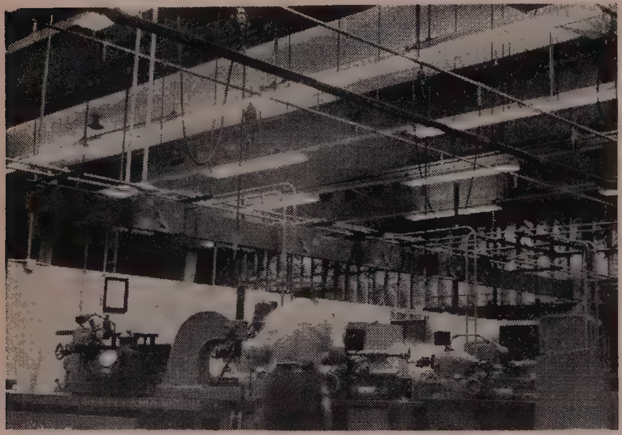
Including 480-volt steam generators, hot water storage tank heaters, strip heaters in air conditioning ducts, exhaust fans and pumps, the connected electrical load in this module is 1422-kva, or 198 amps on the 4160 supply. This load is served by a 1500-kva substation with selector switch, primary feeders and main switchgear rated for 400-amp duty.

Lighting Employs Raceway Grid

Manufacturing modules generally are illuminated by 2-lamp, slotted-canopy, industrial fixtures with 96T-12 lamps operating at 277 volts and 1500 milliamps. Fixtures attach directly to continuous runs of suspended wireways spaced on 10-ft centers at a height of 16 ft. At present, luminaires are


Primary
3-position selector switch
2000-A main ckt. bkr.
Front View: Substation in Module No.7 (typical)
Removable lifting eyes
High voltage
Pull and cable landing compartment for 4160-v feeders T and H; interlocked
Base bolted to floor-flush channels
4160-v primaries
T
H
S
G
Ground
Distrib. panel 120/208-v
300-kva transformer 480-120/208-v
1500-kva transf.
Module No.7
Module No.12
Distribution panel
480/277 v
1500-kva transformer 4160-v primary 480/277-v secondary
1250-kva transf.
750-kva transformer 480-120/208-v
4160-v primaries
4160-v 3-position interrupter switch interlocked with feeders S and G
400-AMP 5-KV 3-POSITION SWITCH
3 terminals with 500 MCM lugs for incoming and outgoing feeders
Ground
Distrib. panel 120/208-v
Distrib. panel 480-v power 120/208-v lighting
Barrier
Side view
ARRANGEMENT OF EQUIPMENT IN SUBSTATIONS LOCATED ADJACENTLY IN MODULES NO.7 AND NO.12

TYPICAL SUBSTATIONS are located on opposite sides of common walls to concentrate primary feeder facilities. Second distribution voltage is 480/277, with further step-down to 120/208 volts handled by local dry-type transformers as requir



GENERAL ILLUMINATION in manufacturing modules is provided by 8-ft 2-lamp slotted-canopy industrial fixtures mounted directly to continuous raceways spaced on 10-ft centers at height of 16 ft.

PLUG-IN BUSWAY above manufacturing areas permits circ breaker bus plugs to be concentrated near related machin Branch connections are carried laterally, supported by chan hangers as shown, then drop directly to control panels.

mounted in checkerboard pattern; that is, with 8-ft gaps between 8-ft fixtures. This arrangement results in illumination averaging 125 fc 30 in. above floor level. However, for the future, additional fixtures can be installed in the gaps along wireways to obtain approximately 220 fc.

Manufacturing-module lighting includes some two dozen night-light units which are similar in appearance except for length, which is 4 ft rather than 8.

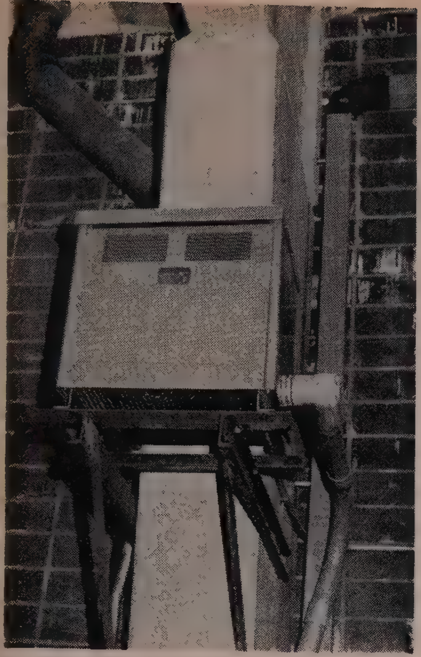
In modules designed for office use, fixtures are stem-mounted 277-volt luminaires. Those installed on the first floor are 4-lamp plastic-louvered assemblies mounted in continuous rows. Those in basements are unlouvered, 2-lamp fixtures mounted individually in functional patterns over specific areas.

A third variation is found in the cafeteria, where fixtures are square, recessed, concave-lensed, incandescent downlights. In the kitchen, raceway-mounted, fluorescent fixtures use 120-volt 430-milliamp lamps. Lobbies have dimmer-controlled, fluorescent troffers installed in combination with recessed, adjustable-beam, louvered, incandescent floodlights.

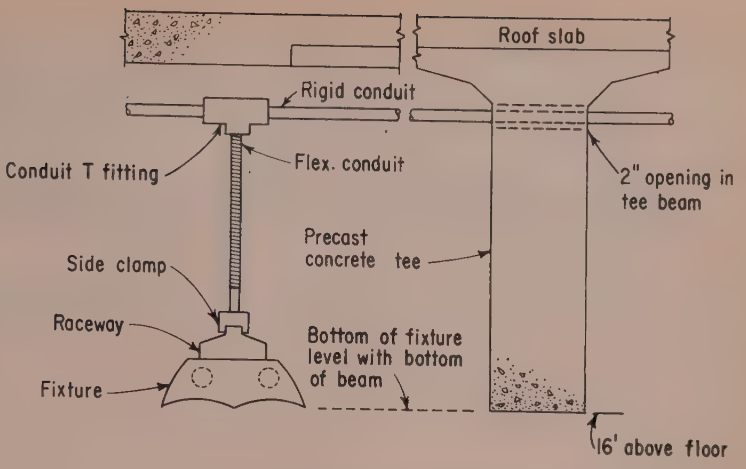
Lights on emergency circuits a
connected to 120/208-volt pan
also served by an automatica
charged, 60-cell storage batt
through a transfer switch.

Nine Miles of Ducts

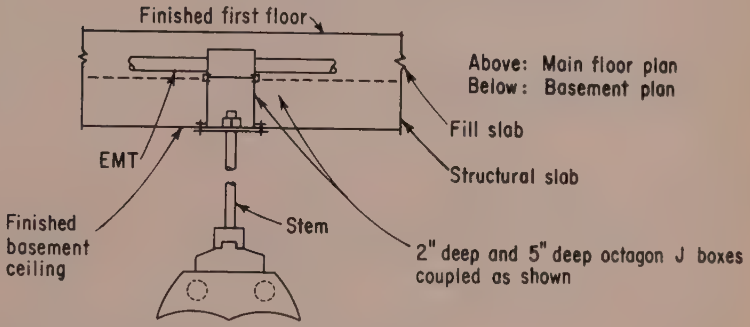
As indicated on the plot pl
4160-volt power is distributed
substations, an air conditioni
central equipment room, cooli
towers and compressor throu
underground ducts. Sections of
distribution system contain
many as 16 4-in. asbestos-cem
conduits encased in concrete.



45-KVA TRANSFORMER is mounted against structural column, supported at height of 10½ ft by channels and braces as shown. Conduit at left connects with floor-mounted 480-volt power panel. Conduit at right drops to 120/208-volt 3-phase, 4-wire circuit breaker. Square wireway then rises to connect with pullbox and power cells of underfloor duct system.



TYPICAL RACEWAY FEEDER CONNECTIONS



CONDUIT FOR LIGHTING main-floor fixtures is carried through openings in webs of roof beams so that bottoms of fixtures will not be below designed beam-to-floor clearance of 16 ft. Maximum mounting height in office-module basements is obtained by placing branch circuit EMT runs in first floor slabs, with coupled octagon boxes supporting short stems and continuous raceways as shown above.

Length of individual conduits totals more than nine miles. They are sloped at 1 ft per 100 ft in the direction of intermediate, double manholes. Buried at least 2 ft below ground surface, these ducts carrying high voltage, are sheathed with red concrete to warn any who might subsequently try to unearth them.

Manhole compartments, 5- by 8- by 7-ft, are accessible through 30-in. covers and steel ladders. They are equipped with ceiling outlets for lights and telephones, 12-in. rock-filled sumps, and pulling irons. They are also equipped with cable racks and hooks. Ground rods and spools connect to a bare, stranded 4/0, copper ground system installed within the partition walls of double manholes. Ground conductors are laid in trenches between manholes and substations and connect with transformers, distribution panels, water mains and ground rods.

When the installation is completed, each 4160-480/277-volt substation will be served through two 5-kv shielded feeders extending from separate buses in the outdoor substation. Tie links between the buses can be closed. With two feeders, one may serve constant loads where close voltage regulation is desired, such as for laboratory and data processing operations. The other feeder may then be allocated for heavy intermittent fluctuating loads, such as electric heating, air conditioning or welding operations. However, if one feeder should be opened, all loads could be served from the other by means of the feeder-selecting switches.

All buildings are heated and air conditioned electrically. The initial installation consists of a 900-ton centrifugal water-chilling machine, two 450-ton cooling towers and six 40,000-CFM fan units. This capacity is more than sufficient to condition air for six buildings, but a considerable amount of this total is used for laboratory processes. Present cooling-tower capacities will permit the addition of another 900-ton centrifugal compressor. When all 18 modules are completed, the air conditioning complex will include *three* 900-ton centrifugal units and *four* 450-ton cooling-towers.

Water is chilled by refrigeration compressors. It is then circulated through heat exchangers by pumps located in equipment rooms located above the modules. Heat exchangers are equipped with electric resistance heating elements. The heaters provide some heat to the air for tempering.

Most of the space heating load in office buildings is handled by additional electric ceiling heating units. Wall thermostats permit local regulation.

Credit for this unique installation belongs to T. Y. Lin and Associates, Van Nuys, Calif., structural designers; Clair J. Bennett, Los Angeles, electrical consulting engineer; Stetson Electric Co., Los Angeles, electrical contractor, and C. B. Atkinson, Telecomputing's plant engineer and coordinator.

● *ESTIMATING FORUM-XXV*

Multipliers for Preliminary Estimates

PART I—Applied to Base Costs for Complete Installations

By Ray Ashley, *Research and Consulting Engineer, Oak Park, Ill.*

STATEMENT:

The last three articles of this forum dealt with the necessity of being able to readily analyze reported contract costs (estimated) of proposed projects. Here, we shall study methods of quickly preparing preliminary estimates when project base costs (purchase price of material and payroll) are known. One recommended method is to develop and use a series of *multipliers* which, when applied to base job costs, will give the complete job cost, installation cost or sell price, whichever is desired.

QUESTIONS:

1. *What is the total markup (approximate) required to establish the sell price of:*
   - *a. A $5,000 base cost (purchase price of material payroll) project?*
   - *b. A $500,000 base cost project?*
2. *Why do contractors prefer the application of detailed markups when preparing estimates for fixed-price bidding?*

ANSWERS:

1a. The total markup on a $5,000 base cost project is 42%. The multiplier is 1.42.

1b. The total markup on a $500,000 base cost project is 25%. The multiplier is 1.25.

2. Contractors prefer to have all detailed figures before them. Special job costs required for the particular job are less likely to be overlooked.

DISCUSSION:

It is important to emphasize that a study of the results attained by using markup combinations must not be delayed until one is hurrying to get out a bid. Ample time must be allotted to such a study and special tables of markup values must be prepared. Such a table is part of the data included in Fig. 1.

Table of Multipliers

The prime objective of the Table in Fig. 1 is to provide suitable multipliers (Columns 9 through 11) for preliminary estimating purposes. A study of the data uncovers other features. The Table also provides individual markups for material and labor; markups suitable to various size projects; and the end result of applying all the listed markups. Best of all, it begins to fix in one's mind what values to expect after all the various markups have been applied. The following items are found in this Table:

1. Base Cost of Project (purchased material and payroll)—Col. 1.
2. Markups for Material—Cols. 2-4.
3. Markups for Labor—Cols. 5-8.
4. Multipliers for Complete Job Cost (base cost plus direct job costs)—Col. 9.
5. Multipliers for Complete Installation Cost (complete job cost plus overhead and insurance)—Col. 10. Note: Insurance is applied along with overhead markup so that it will be subjected to a single markup.
6. Multipliers for Estimated Sell Price after listed markups have been applied—Col. 11.
7. Estimated Sell Price—in dollars—Col. 12.

To illustrate application of the multipliers, let's select the $50,000 base cost project and use the relevant multipliers (Cols. 9-11) in Fig. 1. Then, we would have:

A. Complete Job Cost = 1.04 × $50,000 = $52,000

B. Complete Installation Cost = 1.20 × $50,000 = $60,000

C. Estimated Sell Price = 1.29 × $50,000 = $64,500

Computing the Multipliers

The multipliers for the selected $50,000 base cost project were computed as indicated by the following estimate and calculations. Two methods are shown. One is based on the actual dollar values of an estimate. The other uses percentages only. Both give identical answers. Markups used are shown in the Fig. 1 Table.

FIG. 1—TABLE OF MULTIPLIERS APPLIED TO BASE COSTS

For Complete Installations with a 60/40 MLR

BASE COST OF PROJECT $	MATERIAL MARKUPS (%)			LABOR MARKUPS (%)				MULTIPLIERS (Times Base Cost)			SELL PRICE
	DJC	OH	RET.	DJC	OH	INS.	RET.	Complete Job Cost	Complete Inst. Cost	Sell Price	$
1	2	3	4	5	6	7	8	9	10	11	12
5,000	3	10	8	8	35	10	10	1.05	1.30	1.42	7,100
10,000	3	8	6	7	28	10	10	1.05	1.25	1.35	13,500
20,000	2	7	5	6	25	10	10	1.04	1.23	1.31	26,200
30,000	2	7	5	6	22	10	10	1.04	1.21	1.30	39,000
50,000	2	6	5	6	20	10	10	1.04	1.20	1.29	64,500
75,000	2	5	5	6	18	10	10	1.04	1.18	1.28	96,000
100,000	2	5	5	6	17	10	10	1.04	1.18	1.27	127,000
250,000	2	5	5	6	15	10	10	1.04	1.17	1.26	315,000
500,000	2	4	5	6	14	10	10	1.04	1.16	1.25	625,000
750,000	2	4	5	6	13	10	10	1.04	1.16	1.24	930,000

Abbreviations:
DJC—Direct Job Costs
INS.—Insurance
OH—Overhead

MLR—Material/Labor ratio
MU—Markups
RET.—Return (anticipated profit)

NOTES:
OH values were taken from "Electrical Contracting" (McGraw-Hill Book Co.).
Costs of inspection not included.

The Estimate Method

Cost Division	Material		Labor
1. Base Cost........	$30,000 (60%)		$20,000 (40%)
2. Direct Job Costs (Col. 2).....2%	600	(Col. 5)— 6%	1,200
3. COMPLETE JOB COST..........	$30,600		$21,200
4. Overhead (Col. 3).....6%	1,836	(Col. 6)—20%	4,240
5. Insurance, base labor..........	....	(Col. 7)—10%	2,000
6. COMPLETE INSTALLATION COST..	$32,436		$27,440
7. Return (Col. 4)..5%	1,622	(Col. 8)—10%	2,744
8. SELL PRICES.......	$34,058		$30,184

Using values taken from the above estimate, multipliers are calculated as follows:

A. Complete Job Cost

Complete Job Cost—Material (line 3)...............	$30,600
Complete Job Cost—Labor (line 3).................	21,200
Complete Job Cost............................	$51,800

$$\text{COMPLETE JOB COST MULTIPLIER} = \frac{\text{Complete Job Cost}}{\text{Base Job Cost}}$$

$$= 51{,}800/50{,}000 = 1.036$$

B. Complete Installation Cost

Complete Installation Cost—Material (line 6)..........	$32,436
Complete Installation Cost—Labor (line 6)............	27,440
Complete Installation Cost—The Job.................	$59,876

COMPLETE INSTALLATION COST MULTIPLIER = 59,876/50,000 = 1.1975

Use 1.20 for preliminary estimating.

C. Sell Price

Sell Price—Material (line 8).......................	$34,058
Sell Price—Labor (line 8)..........................	30,184
Sell Price—The Job............................	$64,242

SELL PRICE MULTIPLIER = 64,242/50,000 = 1.2848

Use 1.29 for preliminary estimating.

The Percentage Method

An alternate method of computing base cost multipliers involves the use of percentages only. Here, the base cost of the job is considered 100%. With a 60/40 Material/Labor ratio, material will be 60% and labor 40%. Then, again calculating multipliers for a $50,000 base cost project by applying markups used in the previous example (The Estimate Method), we have:

Cost Division	Material		Labor
1. Base Cost...............	60. (60%)		40. (40%)
2. Direct Job Costs (Col. 2).2%	1.20	(Col. 5)— 6%	2.40
3. Complete Job Cost........	61.20		42.40

A. COMPLETE JOB COST—(61.20+42.40)—103.6% of base cost.

Use 104%, or a MULTIPLIER of 1.04 for preliminary estimating.

Cost Division	Material		Labor
4. Complete Job Cost (line 3)..	61.20		42.40
5. Overhead (Col. 3).....6%	3.67	(Col. 6)—20%	8.48
6. Insurance, base labor......	......	(Col. 7)—10%	4.00
7. Complete Installation Cost..	64.87		54.88

B. COMPLETE INSTALLATION COST—(64.87+54.88)—119.75% of base cost.

Use 120%, or a MULTIPLIER of 1.20 for preliminary estimating.

Cost Division	Material		Labor
8. Complete Installation Cost (line 7)................	64.87		54.88
9. Return (Col. 4).........5%	3.243	(Col. 8)—10%	5.49
10. Sell Price................	68.113		60.37

C. SELL PRICE—(68.11+60.37)—128.48% of base cost.

Use 129%, or a MULTIPLIER of 1.29 for preliminary estimating.

Note that, in using round figures, the computed multipliers have been graded upward. We know from experience that reducing such figures is not prudent.

In the preparation of Tables like this, the estimating of insurance always presents a problem. It is a labor item, but for sound estimating it must not be subjected to the same over-all markups. It is good practice to list labor insurance with the material items and subject it to the same markups. To avoid confusion here, it has been listed with labor and subjected to a single markup (10% return). This is not strictly accurate estimating, but the method is justified here.

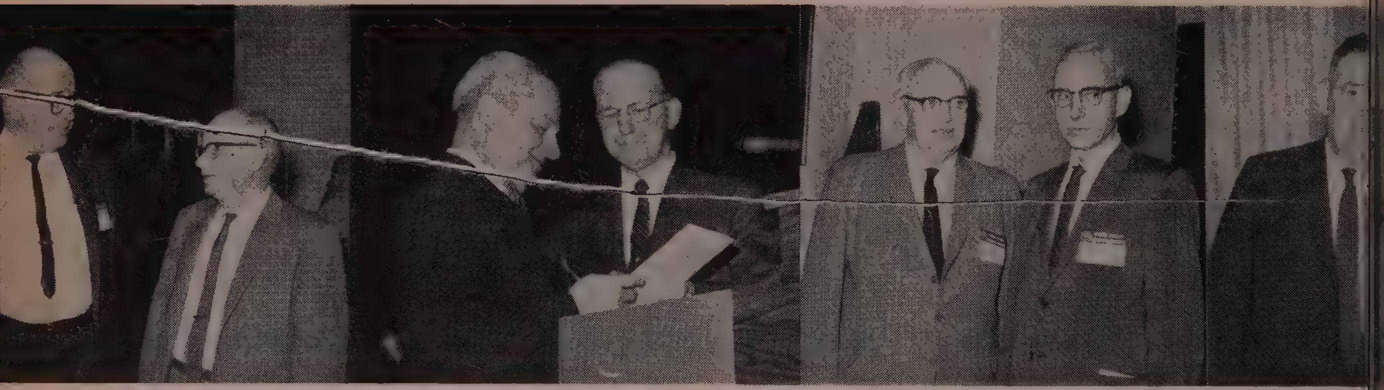
Every estimator should have a close knowledge of how much the base cost must be increased to arrive at: Complete Job Cost; Complete Installation Cost; and Complete Contract Price. A study of the Table in Fig. 1 provides this knowledge. Figures such as those provided in Columns 9, 10, and 11 give him the answers.

The base cost multipliers in the Table are very much in line with the markups used in everyday electrical contracting. They are modest indeed. In a future article on markups for Installation-Only labor, we shall learn that contractors cannot be so modest if they expect to survive.

NECA Meets In Minneapolis

A personality roundup of the 1962 convention of the National Electrical Contractors Association held in conjunction with the 8th National Electrical Exposition, October 9-13. Read about the highlights on page 189.

J. C. Offutt, Electric Service Co., Inc., El Dorado, Ark.; Jack Ketzscher, North Little Rock Electric Co., North Little Rock, Ark.; Harris Mahan, Benson Electric Co., Superior, Wis.; A. J. Bozich, Malton Electric Co., Virginia, Minn.; H. W. Storey, Storey Electric Co., Denver, Colo.; C. I. Berrell, H. P. Foley Co., Salt Lake City, Utah; Clif Canedy, Charlotte, N. C.; Sam Allen, Dallas, Texas; G. C. White, Empire Electric Company, Inc., Ft. Worth, Texas.



L. M. Stewart, Maxwell's Inc., Spokane, Wash.; R. G. Mott, Mott Electric, Spokane, Wash.; Milton Staub, Gustav Hirsch Organization, Inc., Columbus, Ohio, receives Comstock Award from H. A. Webster, president, NECA; John Nash, Magaw Electric Co., Kenosha, Wis.; Louis Jost, Bentley-Jost Electric Co., Milwaukee, Wis.; T. J. Fogarty, Briner Electric Co., St Louis, Mo.

Robert French, Southeastern Electric Co., Detroit, Mich.; R. W. Smith, Southeastern Electric Co., Bay City, Mich.; J. E. Burton, Burton Bros. Electric Co., Ft. Worth, Texas; W. T. Fandel, Fandel Electric, Cedar Rapids, Iowa; C. L. Brost, Olympic Industrial Electric Co., Los Angeles, Calif.; Wayne C. Saari, Peterson Electric Co., Cedar Rapids, Iowa Bill Abright, A-Bright Electric Co., Dallas, Texas; Herb Gold Gotham Electric Co., Dallas, Texas; E. B. Robison, Jr., Hall Fisk Electric Co., Inc., Dallas, Texas.

T. G. Hodgdon, Jr., Franklin Electric Construction Co., Pittsburgh, Pa.; R. G. Frame, Frame Electric Co., Pittsburgh, Pa.; E. J. Hammesfahr, E. J. Hammesfahr Electric Co., Inc., Metuchen, N. J.; Albert P. Manzi, Manzi Electrical Corp., Lawrence, Mass.; William G. Weeks, S. M. Electric Co., Rahway, N. J.; B. L. Slater, Slater Electric Co. of Calif., Folsom, Calif.; G. F. Mason, Mason Electric Co., Las Vegas, Nev.; Wayne Kelly, Kelly Electric Co., Albuquerque, N. M.; T. S. Boyd, Reynolds Electric & Engineering, Albuquerque, N. M.

Harold Bielenberg, Bielenberg Electric, Stillwater, Minn.; Orlin Enerson, Bond Electric Co., St. Paul, Minn.; J. D. Hilburn, Boise-Hilburn Service Co., Kansas City, Mo.; R. W. Wilson, Boise-Hilburn Service Co., Kansas City, Mo.; Maurice Womack, Womack Electric Co., Atlanta, Ga.; Harold Bannister, Motor City Electric Co., Atlanta, Ga.; W. N. Atherton, W. N. Atherton Electric, Saginaw, Mich.; Hugh Laundra, Hugh Laundra Electric, Inc., Saginaw, Mich.

M. H. Dunham, Genesee Electric Co., Flint, Mich.; C. R. Stocks, Stocks Electric Co., Eau Claire, Wis.; J. Colvin, Elco Electric, San Rafael, Calif.; R. A. Bowman, Bowman Electric, Corte Madera, Calif.; H. R. Priestley, H. A. Holder Co., Boston, Mass.; M. R. Minto, MacNutt Electric Co., Inc., New York, N. Y.; Richard Haag, Haag Electric, Geneva, N. Y.; Wenzel Van Amersfort, Van Amersfort Electric, Rochester, N. Y.

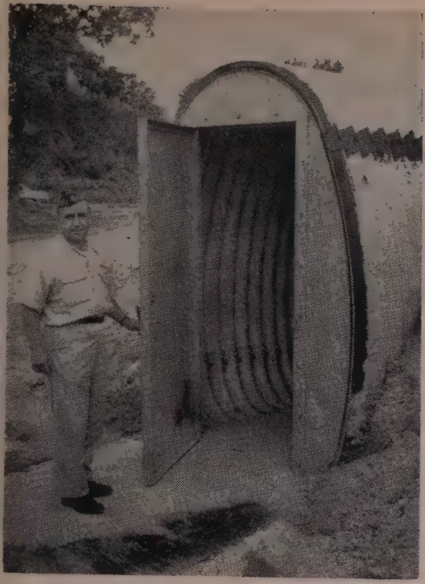
L. E. Heine, Albin Gustafson Co., New York, N. Y.; Louis Kalischer, New York, N. Y.; D. B. Haring, Hatzel & Buehler, Inc., New York, N. Y.; Frank G. Camus, C & C Electric, Shreveport, La., receives Coggeshall Award from H. A. Webster, president, NECA; H. C. Winkelmann, Kaemerlen Electric Co., St. Louis, Mo.; Francis Aschinger, Aschinger Electric Co., St. Louis, Mo.; W. G. Nordling, Nordling, Dean & Company, Inc., Summit, N. J.; E. E. Leasure, Monroe Electric Co., Chicago, Ill.

J. M. Schroeder, Midwestern Electric Construction Inc., Grand Forks, N. D.; Barney Bentsen, Interstate Electric, Rapid City, S. D.; O. H. Pederson, Edling Electric Inc., Moorehead, Minn,; R. O. Thue, F-M Electric, Fargo, N. D.; W. D. Vance, Jr., California Electric Co., Oakland, Calif.; K. W. Carlson, NECA Manager, Sacramento, Calif.; C. L. Brunelle, Concord Electric, Concord, Calif.; Ted Lloyd, Lloyd Electric, Inc., Oklahoma City, Okla.; Charles Echols, Belco, Inc., Oklahoma City.; L. V. Mayfield, Mayfield Engineering Co., Colorado Springs, Colo.; W. R. Boyington, Boyington Electric Co., Oklahoma City, Okla.

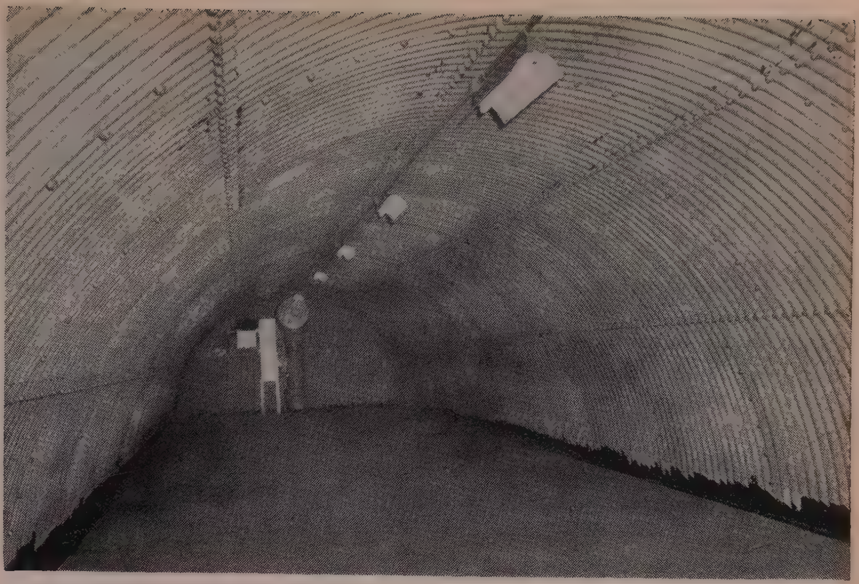
Harold Baumer, Vanderlinde Electric Corp., Rochester, N. Y.; J. H. Friedland, Lightning Electric Service Co., Newark, N. J.; A. O. Holmes, Holmes Electric, Inc., Minot, N. D.; A. D. Hagenstein, Main Electric, Inc., Minot, N. D.; Melvin Oien, Thompson Electric Co., Cloquet, Minn.; Erle Mitchell, Commercial Electric Co., Duluth, Minn.; Vernon Hammond, J. M. Clayton Co., Atlanta, Ga.; Ed Walton, Dixie Electric Co., Atlanta, Ga.; J. B. Schaeffer, Sachs Electric Corp., St. Louis, Mo.; G. L. Gamp, Gamp Electric Co., St. Louis, Mo.

H. Friedman, Thomas Henry Electric, West Nyack, N. Y.; W. Heady, Heady Electric, Hyde Park, N. Y.; Philip Popik, The Lightmore Co., Spring Valley, N. Y.; Roy W. Springer, Jr., Roy W. Springer, Ross Electric Co., Superior, Wis.; James A. Hitchcock, Jr., Paul Wendt Electric Co., St. Louis, Mo.; R. E. Vierheller, St. Louis Chapter NECA; C. J. Hervey, C. J. Hervey Electric Co., St. Louis, Mo.; Louis Waldman, L. I. Waldman & Co., New York City; William Leibfried, Wm. Leibfried, Inc., New York City; J. R. Mann, E-J Electric Installation Co., New York City.

C. W. Abrell, E. P. Allison Co., Inc., Chicago, Ill.; Norm Crystal, Luminous Ceilings, Chicago, Ill.; L. W. Johnson, Johnson Electric Co., Chicago, Ill.; J. W. Albright, Triangle Electric Co., Detroit, Mich.; Francis Tufts, John H. Busby Co., Detroit, Mich.; R. W. Colgan, Rogers Electric Service Inc., Toledo, Ohio; Ray Toska, Toledo, Ohio; P. R. Bigley, Bigley Electric Co., Findlay, Ohio; L. B. Haas, Romanoff-Haas Electric Service Co., Toledo, Ohio; Morris Dorn, Dorn Electric, Maumee, Ohio.



FALLOUT SHELTER steel door is opened by Major F. M. Sherman, Base Engineer, who, in cooperation with New York State engineers, coordinated construction of the shelter. Shelter consists of Quonset-hut type galvanized-steel structures and a smaller, steel connecting tunnel under 3 ft of earth.



LIGHTING in main shelter areas is supplied from industrial-type fluorescent fixtures with single 40-watt lamps. To insure fluorescent lamp operation during the first hours of use during cold weather, low-temperature ballasts were selected. Lighting level is at 2 footcandles.

Electrical Specifications for . . .

Prototype Fallout Shelter

Here are electrical details on a recently completed group fallout shelter which was designed by the New York State Department of Architecture.

By Robert J. Lawrie

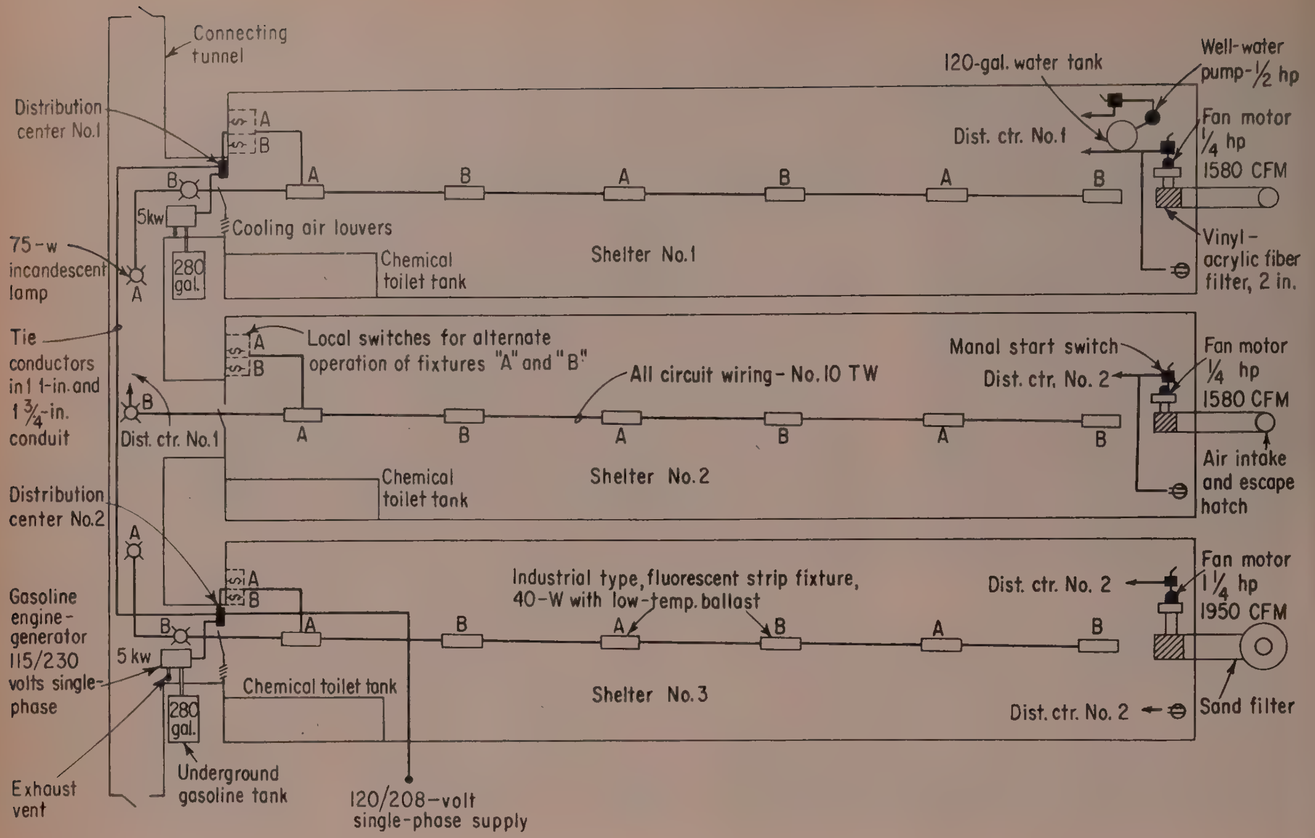
AT THE National Air Guard station, Westchester County Airport, White Plains, N. Y., a meticulously designed group fallout shelter, capable of protecting 600 people, will serve as a prototype guide for designers and builders of other shelter spaces, will allow testing of shelter design factors, and, in the event of atomic attack, will provide shelter for air guardsmen and nearby residents for a period of two weeks.

Representing but one phase of New York State's many-faceted shelter program, the new fallout shelter provides maximum protection and adequate utility services at minimum cost. Total cost of construction, including equipment, was about $75,000 or $125 per person.

Applying precision design, engineers were able to provide a very high radiation protection factor of over 1000 as well as excellent reliability in all utilities. For example, electric power can be obtained from a normal utility supply or from either of two 5-kw engine generators through load transfer switching. In addition, fluorescent fixtures are equipped with low-temperature ballasts to insure lamp operation during the first hours of use during cold weather. (Underground shelters are not heated because body heat from occupants will raise the surrounding air temperature to a comfortable level in a short time.)

From the outside, the shelter appears as a large mound of dirt with several silvery vent pipes protruding into the air. Underneath the soil, however, are three Quonset-hut type steel buildings each measuring 20 ft by 100 ft. A cross-section through the mound would reveal 3 ft of earth over the 12-gauge galvanized steel buildings, which would appear very much like a script "m." Semi-cylindrical in shape, each structure is 10 ft high in the center and rests on a concrete floor, which is about 5 ft below grade.

A similar but smaller steel structure forms a tunnel connecting the three shelter entrances, which are located at the end of each main shelter building. Access to the shelter is made through steel doors


Connecting tunnel
Distribution center No.1
A
B
75-w incandescent lamp
Tie conductors in 1-in. and 1 3/4-in. conduit
Distribution center No.2
Gasoline engine-generator 115/230 volts single-phase
Exhaust vent
5kw
280 gal.
Cooling air louvers
Chemical toilet tank
Shelter No.1
120-gal. water tank
Well-water pump-1/2 hp
Dist. ctr. No.1
Fan motor 1/4 hp 1580 CFM
Vinyl-acrylic fiber filter, 2 in.
Local switches for alternate operation of fixtures "A" and "B"
All circuit wiring - No. 10 TW
Manal start switch
Dist. ctr. No. 2
Fan motor 1/4 hp 1580 CFM
Air intake and escape hatch
Dist. ctr. No.1
Shelter No.2
Industrial type, fluorescent strip fixture, 40-W with low-temp. ballast
Dist. ctr. No. 2
Fan motor 1 1/4 hp 1950 CFM
Sand filter
Shelter No.3
Chemical toilet tank
5 kw
Underground gasoline tank
120/208-volt single-phase supply

ELECTRICAL LAYOUT shows major electrical system components. Either of the twin 5-kw gasoline engine generators or the normal utility service can be selected to power shelter equipment. Ten circuits of No. 10 RH conductor in rigid metal conduit supply lighting loads, receptacles, blower motors and pumps. All conduit, boxes, etc. are of watertight design.

located at the ends of the connecting tunnel. All sections of the shelter are of bolted construction and are completely waterproofed.

Electrical System

Power is supplied at 120 volts, single-phase from a nearby building to a distribution center located near one end of the connecting tunnel. A second distribution center is located at the other end of the tunnel.

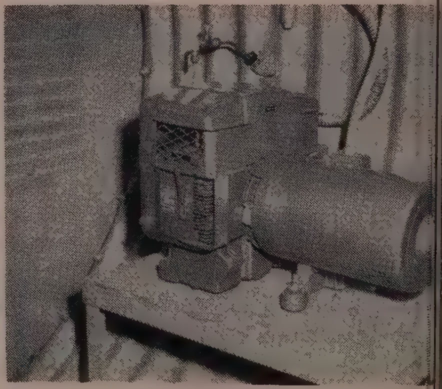
If utility power should fail, two 5-kw gasoline engine-generator sets, installed in the tunnel near distribution centers, are available to supply 115/230 volts to electrical loads. This arrangement provides high reliability because each generator is capable of supplying full shelter electrical requirements. The generators were sized to provide approximately 8 watts per shelter occupant.

The driving gasoline engine is a 2-cylinder, 4-cycle, air-cooled unit, which is manually started with a pull-recoil starter. For each engine, a 280-gallon gasoline tank is installed underground and contains enough fuel to operate each engine for two weeks.

A transfer switching arrangement allows transfer of power between normal service and either of the two generators. Transfer switches are manual 30-amp DPDT switches. Mounted in 100-amp frames, 30-amp molded-case circuit breakers protect the generator lines.

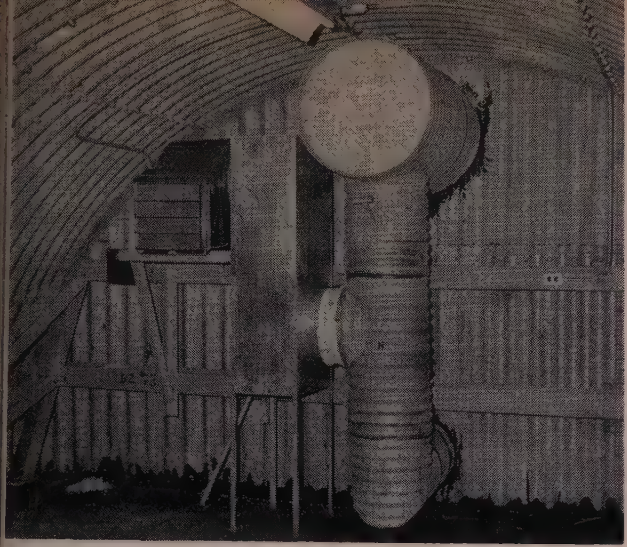
The shelter required ten circuits, five from each lighting panel. Each circuit is protected by a 20-amp circuit breaker.

Lighting levels in the main shelter areas are at a maintained 2 footcandles. In each section, six industrial-type fluorescent fixtures, equipped with a single 40-watt lamp, provide illumination. These fixtures are locally switched in an arrangement that affords alternate operation of each fixture. This provides alternate darkened areas for sleeping yet allows some light in all areas for safety. In the connecting tunnel, five 75-watt incandescent lamps equipped with industrial reflectors were installed.

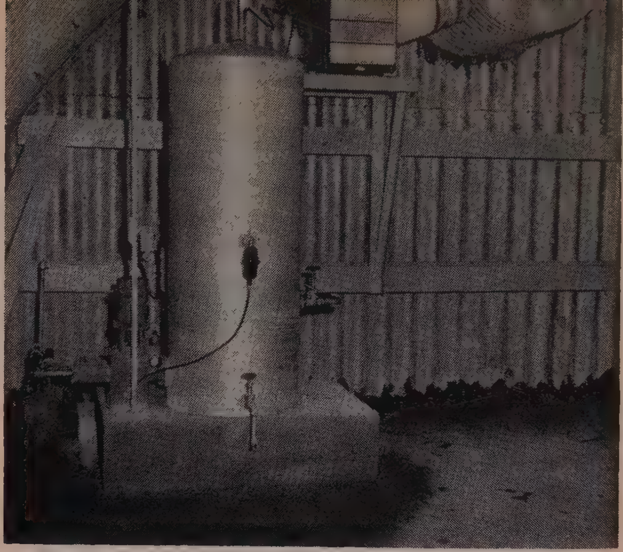


ENGINE-GENERATOR SET, one of two twin units, is gasoline powered, rated 5 kw at 115/230 volts, single-phase. Engine is a 2-cylinder, 4-cycle, air-cooled unit with manual starting. Liquid-tight flexible metal conduit extend from generator terminal box. Larger flexible metal pipe carries exhaust from engine to outside. Small pipe at rear of engine is gasoline supply line. Cooling air louvers are at left of photo.

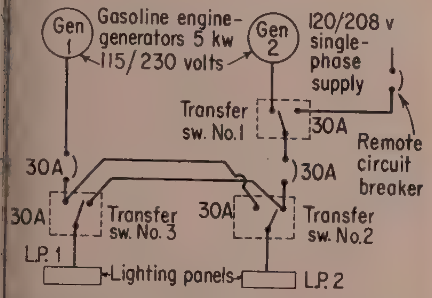
Other electrical loads include a duplex receptacle in each shelter



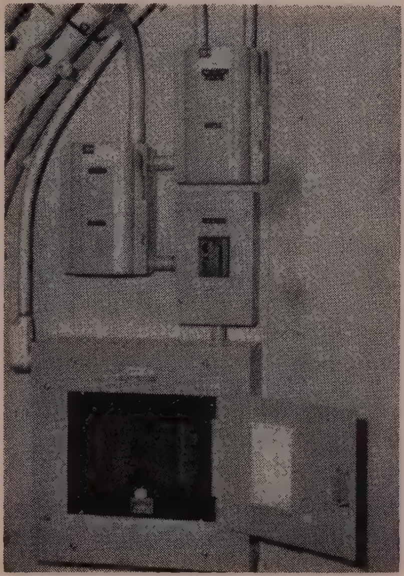
VENTILATION in shelter area No. 3 is provided by a 1950 CFM blower unit driven by a 1¼-hp motor. Vinyl-acrylic pun-fiber filter provides effective protection from radio-active dust. On the right is a sand filter which will be tested or its effectiveness in cooling hot air created by fire-storm.



WATER SUPPLY is derived from a driven well located in the left corner of shelter area No. 1. A ½-hp pump delivers water to the 120-gallon hydro-pneumatic tank to obtain water pressure. Pump control is via a pressure switch and a manual, 2-pole, across-the-line starter.



DOUBLE TRANSFER SWITCHING arrangement is shown in one-line diagram. Transfer switch No. 1 allows power to be supplied from either normal utility service or from generator 2. Transfer switches Nos. 2 and 3 can be positioned to allow the total shelter electrical load to be fed from either generator.



DISTRIBUTION CENTER is one of two that provides protection and control of the electrical system. Switch at top right is DPDT transfer switch, which allows transfer of power between normal service and generator 2. Directly below this switch is the main 30-amp circuit breaker mounted in a 100-amp frame. Below the main breaker is lighting panel No. 2. Transfer switching between generators 1 and 2 is accomplished by the switch at the left.

PREFABRICATED steel straps facilitated mounting of conduit, boxes, etc. to the underground steel walls. Straps are easily mounted on building bolts; standard conduit straps are then attached to the predrilled steel straps.

area, a ½-hp motor for the well-water pump, two ¼-hp motors for ventilating blowers in shelters No. 1 and No. 2, and a 1¼-hp motor on the ventilating system equipped with a special filter in shelter No. 3.

All circuit wiring was accomplished with No. 10 RHW conductors carried in rigid steel conduit. Because of the possibility of condensation when the shelter is not in use, all couplings, boxes and fittings are of watertight construction. Also, to provide vibration insulation as well as protection from moisture, liquid-tight flexible metal conduit was used at the generators and at motors.

Because of the underground steel-wall construction, mounting of conduit, boxes, fixtures, etc. presented a problem. If holes were drilled to accept mounting bolts, permanent waterproofing at each hole location would have required excessive time and costs. However, the electrical contractor, Hammond Electric Co., Mount Kisco, N. Y., solved the problem by fabricating special mounting straps which could be quickly attached to the building bolts. As shown in an accompanying photo, standard conduit straps were then easily bolted to the pre-drilled steel strap.

Other facilities include the ventilation equipment, which consists of two 1580 CFM, ¼-hp blower assemblies in shelters No. 1 and No. 2 and a 1950 CFM, 1¼-hp unit in shelter No. 3. On the 1580 CFM units, vinyl-acrylic spun-fiber filters provide effective protection from radiation-laden dust. The 1950 CFM unit is also equipped with a vinyl-acrylic filter but, in addition, has a special sand filter upon which experiments will be made to test its effectiveness in cooling hot air created by fire-storm. Air-intake ductwork on all units will also serve as escape hatches if necessary.

To provide added reliability, spare motors, pump, filters and blower parts were supplied.

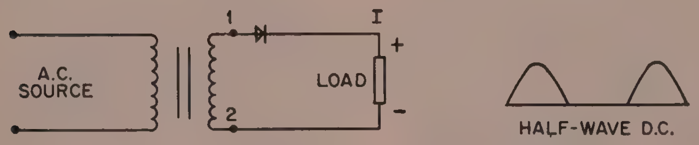
Equipment and supplies to be installed include bunk beds, radio equipment, first-aid supplies, nonperishable food and the like.

For ac to dc conversion . . .

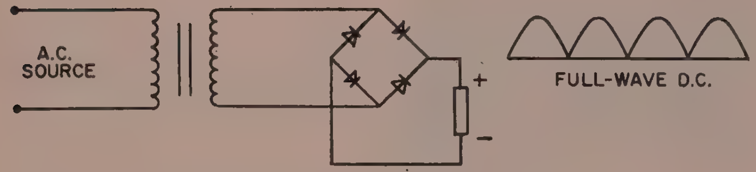
Industrial Ignitron Rectifiers

Rectifier circuits and ignitron rectifiers—part 2 of a 3-part series of articles which describes characteristics, ratings and operation of power-conversion apparatus.

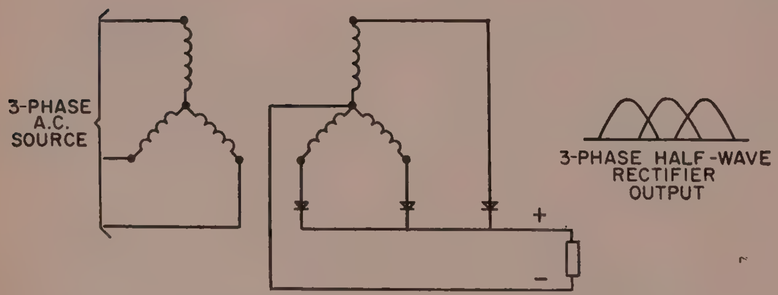
By Charles G. Cloern, *Power Conversion Engineer*
Westinghouse Electric Corp., East Pittsburgh, Pa.



SINGLE-PHASE HALF-WAVE



SINGLE-PHASE FULL-WAVE



THREE-PHASE WYE SINGLE-WAY

FIG. 1—Basic rectifier circuits include the single-phase half-wave arrangement which is normally applied only for low-power applications; this circuit has poor efficiency and high ripple. The single-phase full-wave circuit is an improvement over the half-wave type; it can handle higher currents, has better efficiency and less ripple. The 3-phase wye single-way arrangement has high power capacity and high efficiency but the associated transformer core tends to become saturated by the dc current thus increasing core losses.

RECTIFIERS afford a stat
means of obtaining dc pow
from an ac source by utilizin
their ability to pass current in o
direction only. Ignitrons and sil
con rectifiers possess this unidire
tional current-carrying ability a
are commonly applied in speci
circuits to provide dc power. B
fore discussing the rectifier el
ments, it is best to examine the
circuits with a view toward unde
standing their characteristics a
well as the requirements which the
impose upon rectifier elements.

The simplest rectifier circuit
the single-phase half-wave arrang
ment as shown in Fig. 1. Durin
the half cycle when terminal 1
positive with respect to termin
2, current flows as shown throug
the rectifier in the forward dire
tion, through the load and back
terminal 2. The rectifier preven
the flow of current during the ha
cycle when terminal 2 is positiv
with respect to terminal 1, henc
a pulsating dc current is produce
And, because these pulsations co
sist of only one half of the ac wav
a high ripple (121%) and lo
efficiency (25-30%) results. Th
this circuit is rarely used in indus
trial applications.

Examination of the circuit show
that the rectifier must have a cu
rent-carrying capacity equal to th
load current since the two are co
nected in series. Also the rectifie
must be able to withstand withou
damage the peak value of the a
voltage in the reverse direction.

Where the pulsating nature
the dc current produced by th
single-phase half-wave circuit
objectionable, or greater power ou
put is required, the single-phas
full-wave rectifier circuit is use
For the same ac voltage input, th
circuit results in an average d
voltage twice as high as that
the half-wave type with much les
dc ripple. This rectifier must stan
the same applied voltage in th
reverse direction as the half-wav
circuit.

The rectifier circuits discusse
thus far are economical in ver
low power applications only. F
high-power industrial rectifiers an
circuits, multiphase ac voltage
commonly used. Fig. 1 also show
a 3-phase, wye, single-way rectifie
circuit. This circuit would fin
widespread use except that dc cu
rent flowing in the phase winding
saturates the transformer core in
creasing the core losses. Otherwis

e circuit has important advan-
ges such as long rectifier con-
ction angle resulting in high
ansformer utilization and rela-
vely low inherent regulation.

For increased effectiveness, the
phase double-wye, single-way cir-
uit (Fig. 2) yields the advantage
the 3-phase wye circuit without
y of the disadvantages associated
ith transformer core saturation.
aturation is avoided by winding
ansformer coils which are 180
egrees out of phase on the same
ore. The action of this interphase
ansformer is to make each 3-
hase secondary group operate in-
ependently, resulting in six pul-
ations per cycle instead of three.
his provides less ripple and a
mooth dc voltage output. This cir-
uit is often used with ignitron
ectifiers.

A 6-phase, double-way bridge
ircuit shown in Fig. 2 results in a
c output voltage with the same
aveform as the double-wye, single-
ay circuit without the necessity
f an interphase transformer. This
ircuit configuration results in high
ransformer utilization and is com-
nonly used in conjunction with
emiconductor rectifiers for indus-
rial power conversion applications.

Mercury Arc Rectifier

The mercury arc rectifier was
irst developed around the turn of
he century utilizing a glass bulb enclosure. Because of the low mechanical strength of glass, this design was limited in power handling capability. As a result, the steel tank enclosure was developed to handle large amounts of power.

Since the introduction of the mercury arc rectifier, they have been built in numerous forms, such as single or multianode, intermittent or continuous excitation, and sealed or pumped tube, but they all depend upon the properties of ionized mercury vapor for their operation. A cutaway view of a sealed-tube ignitron, a popular type of mercury arc tube, is shown in Fig. 3.

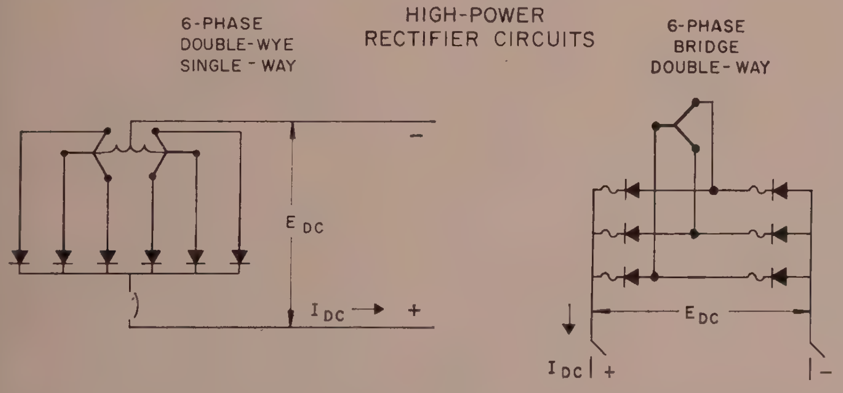
Mercury arc rectifier operation is based on the principle that in an ionized gas at low pressures, a small positive potential on the anode will cause a relatively large current to flow from the negative electrode, or cathode, if a "cathode spot," which emits electrons, is formed at the cathode. And this undirectional current can flow only if a positive potential is applied to the anode during the time that a cathode spot exists on the negative electrode. Thus, when the anode is positive (and the aforementioned conditions are met), the tube conducts; when the anode is negative, the tube will not conduct. Therefore, with an ac input voltage applied to the anode, the resulting output will be a pulsating dc current.

Mercury, having the right characteristics required, is ideally suited for the negative electrode. The mercury is vaporized at temperatures and pressures readily attainable and easily maintained within the vacuum chamber and provides the path for the current flow. The anode, or positive electrode, is made of graphite because of its unique characteristics at high operating temperatures. These characteristics are low resistance to current flow, and the ability to operate at very high temperature without creating excessive hot spots or electron producing areas of its own. On occasion, these hot spots do occur in mercury arc tubes. This phenomenon, called arc back, results in a high magnitude of reverse current which places severe short-circuit stresses throughout the rectifier assembly and persists until circuit interrupting devices open to protect the circuit.

The method of starting the arc is based on the fact that when a current is passed through a junction of a high resistance and a low resistance, a potential gradient occurs which is of sufficient magnitude to create a cathode spot. In this instance, the high and low resistance is the ignitor and the mercury pool cathode respectively. Special phase-shifting circuitry supplies pulses of current to obtain the cathode spot at the precise time. And auxiliary anodes are provided to maintain the cathode spot until such time as the main anode begins conducting, thus insuring stable arc operation.

As previously stated, arc backs occasionally occur in mercury arc rectifiers. Examination of the double-wye, single-way circuit, which is commonly used with ignitron rectifiers, will show that during an arc back the transformer secondary is short circuited. In addition, there is a short circuit on the dc bus, resulting in large fault currents on most systems. This condition requires that semi-high-speed switchgear be employed on both the ac and dc side to isolate the fault as quickly as possible. In most instances, the equipment can be returned to service immediately since removing the voltage eliminates the arc-back condition as well.

The magnitude of the fault current from the ac source depends primarily on the transformer reactance. That is, a high-reactance transformer would limit the current to a comparatively low value.



CIRCUIT RELATIONSHIPS

		SINGLE-WAY	DOUBLE-WAY
RECTIFIER ELEMENT	AVE CURRENT	$.167\ I_{DC}$	$.33\ I_{DC}$
RECTIFIER ELEMENT	PEAK CURRENT	$.5\ I_{DC}$	$1.0\ I_{DC}$
RECTIFIER ELEMENT	PEAK INVERSE VOLTAGE	$2.09\ E_{DC}$	$1.05\ E_{DC}$
TRANSF. TERMINAL	RMS CURRENT	$.289\ I_{dc}$	$.817\ I_{dc}$
TRANSF. SECONDARY	RMS VOLTS LINE TO NEUTRAL	$.855\ E_{DC}$	$.428\ E_{DC}$
TRANSF. SECONDARY	KVA	1.48 EI	1.05 EI

FIG. 2—Powered from a 3-phase source, the rectifier circuits shown provide six dc pulses per ac cycle allowing a relatively smooth direct current to flow. The double-wye single-way arrangement is often used with ignitrons. The double-way bridge circuit is commonly applied in conjunction with silicon rectifiers.

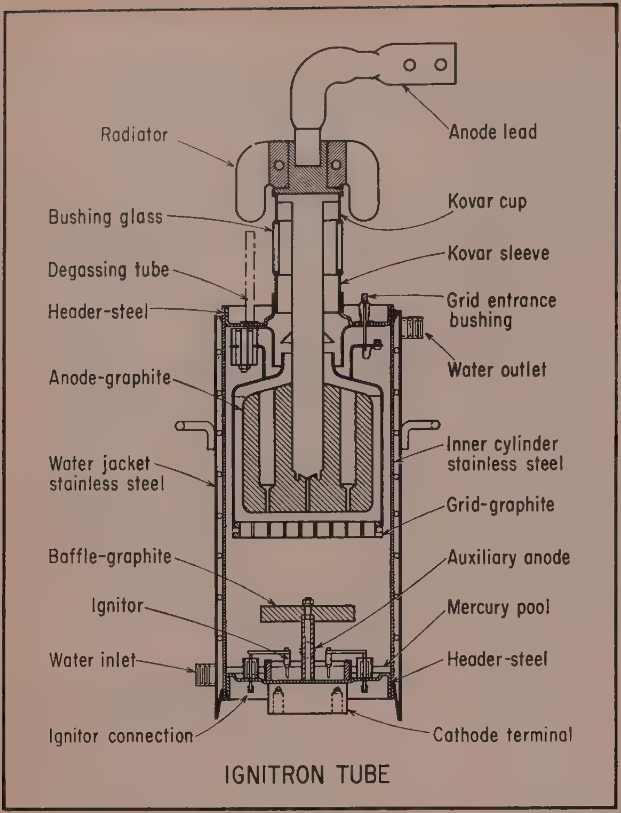


FIG. 3—Cross-section of a typical sealed-ignitron rectifier shows internal construction. Note that two ignitors are furnished so that the tube will still be operable if one ignitor fails. The graphite baffle helps prevent arc backs.

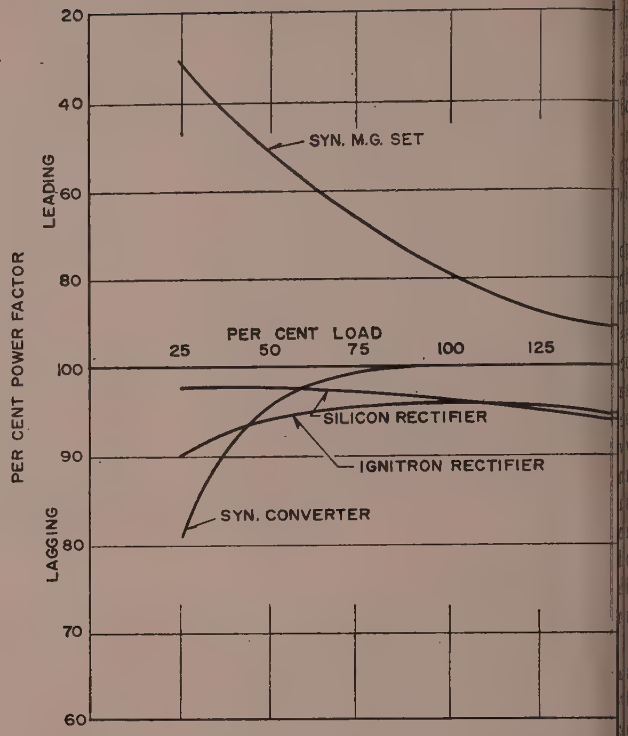


FIG. 4—Power factor of the ignitron rectifier depends basica on the associated transformer reactance. At light loading the power factor of the ignitron rectifier drops off becau of reactive phase-shift circuitry.

However, the voltage regulation of the rectifier is directly proportional to the transformer reactance and it is desired that the rectifier have low inherent regulation. Therefore, the transformer used should have a reactance that will limit short-circuit current without defeating good regulation.

Over-all economics dictate a transformer reactance of approximately 9%, which, when combined with the reactance and resistances in the usual industrial system, provides an approximate over-all voltage regulation of about 7%.

The maximum voltage obtainable from the ignitron rectifier is limited by the transformer design. However, if the ignitor pulse is delayed beyond the time when the main anode would normally begin to conduct, the effect will be a reduction in the average dc output voltage. Thus, the output voltage can be accurately maintained at the desired value by automatically varying the pulse position, or firing angle of the ignitor.

The power factor of any rectifier is independent of the rectifying elements employed, but it does depend on the transformer reactance. The power factor of a typical ignitron rectifier for industrial duty is shown by Fig. 4. If the ignitor firing point is delayed, to effect a voltage reduction, the power factor is proportionately reduced.

The losses of an ignitron rectifier consist of copper losses, which vary as the square of the load; transformer-iron and auxiliary losses, which are practically constant regardless of load; and ignitron-tube arc-drop losses, which are proportional to load current since the arc-drop voltage is practically constant. The resulting efficiency of ignitron rectifiers is thus relatively high (over 90%) across a wide range of loading. And the ignitrons relatively high efficiency at light load is important in industrial applications since such loads are often erratic in nature with frequent periods of light load operation.

Ignitron rectifiers are rated according to the applicable ASA Standards. For industrial applications the rectifiers are rated 100% full load continuous, 125% full load for two hours, or 200% full load for one minute following full-load operation. Rated overloads and high momentary swings ha no injurious effects on ignitron re tifiers—in contrast to rotati equipment—so that overloads, specified in the ratings, may tolerated without additional maint nance expense.

These rectifiers must be pract cally free of all gases other tha the mercury vapor for successf operation. And two types of evac ated tubes are used, sealed tube and continuously pumped tube Fig. 5 shows various sizes of ign tron tubes available.

Sealed-tube operation is inhe ently simpler because vacuu maintaining equipment is not r quired. But the tube vacuum important because the life of sealed tube is primarily depende upon the thoroughness with whi it is degassed. Normally, all tu parts are degassed at temperatur considerably higher than tho reached during normal operatio All sealed tubes, however, aft years of operation will emit enoug trapped gases from internal par to interfere with proper tube o eration. However, long experien has shown their average life to about seven years.

A schematic diagram of a umped-tube system is shown in ig. 6. The life of a pumped tube indefinite but periodic overhaul necessary to maintain the tube reliable operating condition. A t of vacuum-maintaining and inicating equipment is necessary to emove any foreign gases that appear in the tank after heavy overads or short circuits.

To control the mercury-vapor ressure in the vacuum chamber, eat dissipated by the mercury arc ust be removed. This is most imply accomplished by a wateroling system. The water input nd output temperatures are acurately controlled by an automatic alve, which operates thermally aditting water in proportion to the rc losses to provide the required ercury-vapor temperature. Water ischarged from the cooling system s normally maintained at approxiately 55° C.

If good quality water, free from cids, solids and scale-forming maerials, is available, direct cooling an be used. If the required quality f cooling water is not available for irect cooling, a water-to-water eat exchanger is used. If a supply f cooling water is not available, recirculating system with watero-air heat exchanger is used. In his system, the correct water temperature is maintained by autoatic control of a motor-driven an. Additional cooling is provided or the anode by providing it with etallic radiators.

Protective equipment furnished n a typical sealed-tube ignitron ectifier assembly consists of proective devices for ac undervoltage, c overcurrent, single or reverse hase ac, dc overcurrent, dc reverse urrent, transformer overtempeaure, cooling water overtemperaure, cooling water underpressure, ignitron-tube overtemperature, persistent ignitor misfire, and protection for auxiliary equipment. These various protective devices either trip the circuit breakers or sound an alarm according to the applicable ASA Standards and customer requirements.

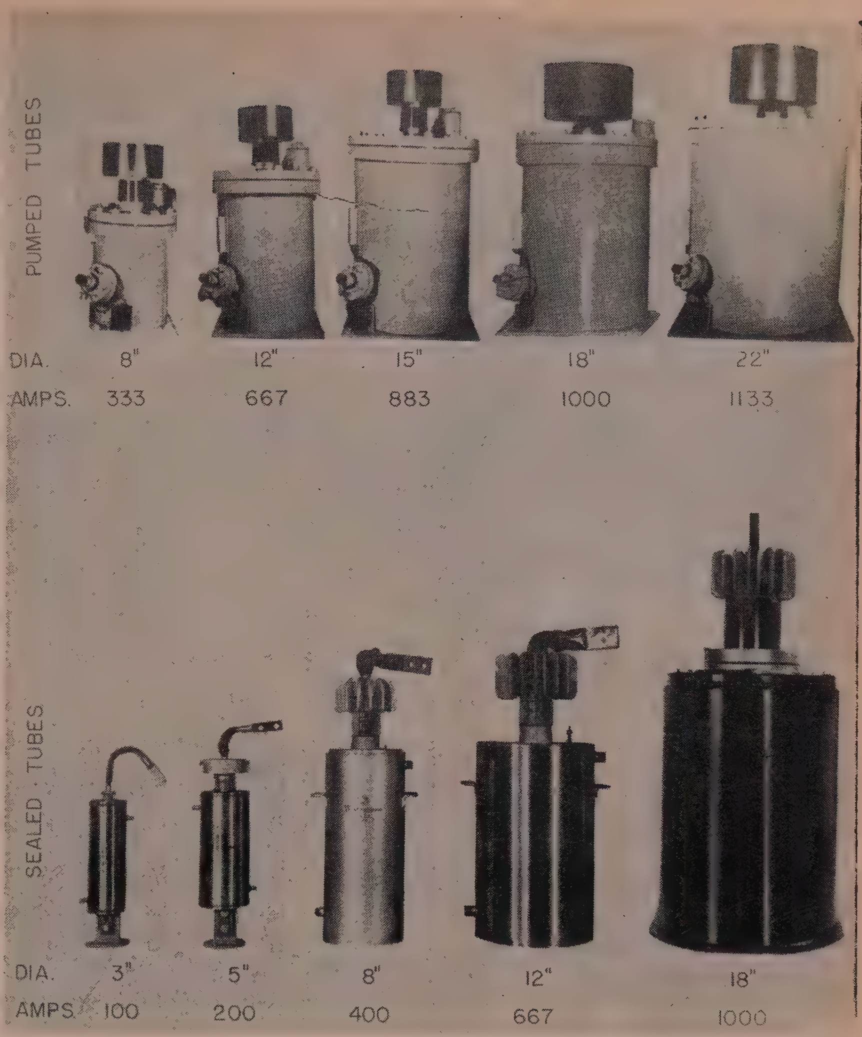


FIG. 5—Ignitrons may be of sealed-tube construction or they may be the pumped-tube type, which requires a pumping system to maintain vacuum. Sealed tubes are simpler to maintain, have an average life of about seven years. Pumped tubes may last indefinitely.

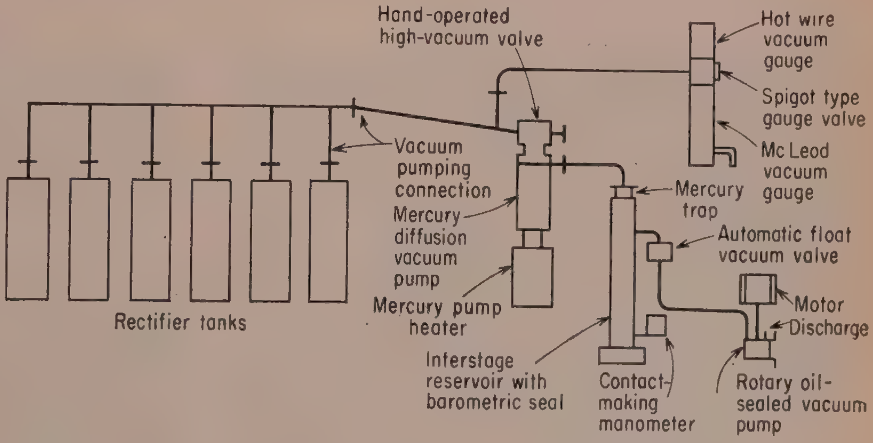

Hand-operated high-vacuum valve
Hot wire vacuum gauge
Spigot type gauge valve
Mc Leod vacuum gauge
Vacuum pumping connection
Mercury diffusion vacuum pump
Mercury trap
Automatic float vacuum valve
Motor
Discharge
Rectifier tanks
Mercury pump heater
Interstage reservoir with barometric seal
Contact-making manometer
Rotary oil-sealed vacuum pump

FIG. 6—Vacuum pumping system for pumped-tube ignitron rectifier requires extensive equipment and control devices. The pumping system removes gases which form inside the tank and maintain the proper operating vacuum.

Ignitron substations are supplied as free-standing, close-coupled metal-enclosed cubicles of equipment consisting of ac switchgear, transformer, rectifier and excitation equipment, dc switchgear and control sections as required by the particular application. Transformer equipment is either askarel or air cooled for indoor close-coupled units or oil cooled for outdoor installation. Standard units are suitable for supply voltages from 2300 to 13,800 volts.

Although ignitron equipment does not require elaborate foundations for satisfactory operation, it should not be installed in areas subject to severe jarring. Continuous vibration could result in premature ignitron-tube failure due to ignitor breakage, as well as other mechanical failures that could occur.

Traffic Regulated By Relays

Illuminated signals and annunciators direct traffic at Denver bank, where bank-by-car facilities include ten drive-up tellers' windows and four incoming traffic lanes. Operation of system is automatic, with pneumatic treadles, clocks, relays and sequencing devices regulating movement of the automobiles.

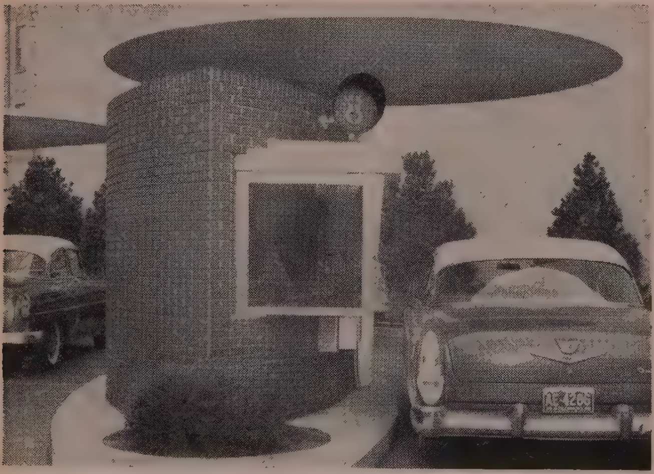
DRIVE-IN banking is a convenient service; a fast, easy method for depositing or withdrawing money. Motorists adopting this practice are increasing in numbers steadily. And, as numbers of customers increase, it becomes necessary to employ more tellers to handle such transactions.

In the case of the Denver Bank and Trust Company, this volume now requires the services of ten tellers. Five tellers' windows are spaced around a large rotunda. The remaining five are contained in satellite structures separated from the main building by a wide driveway.

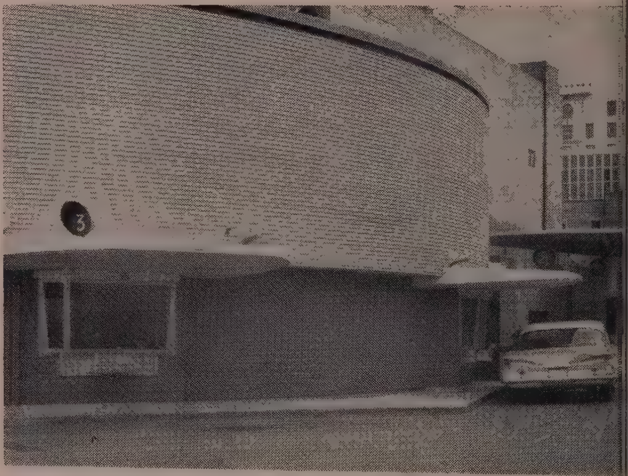
Since the number of separate customer transactions frequently exceeds 200 per hour and since motorists approach the drive-in area from two 2-lane entrances located on different streets, it is essential to control traffic. Movement of cars is regulated in three patterns. One pattern is used when traffic is normal, that is, when cars approaching through both entrances are approximately equal in volume. The other two patterns are used when traffic densities at entrances are unbalanced.

Under normal conditions traffic from each entrance is handled by five tellers. Cars entering from the northern entrance, lanes 1 and 2 are directed to proceed to windows 1 through 5 inclusive. Cars approaching from western lanes 3 and 4 proceed to windows 6 through 10.

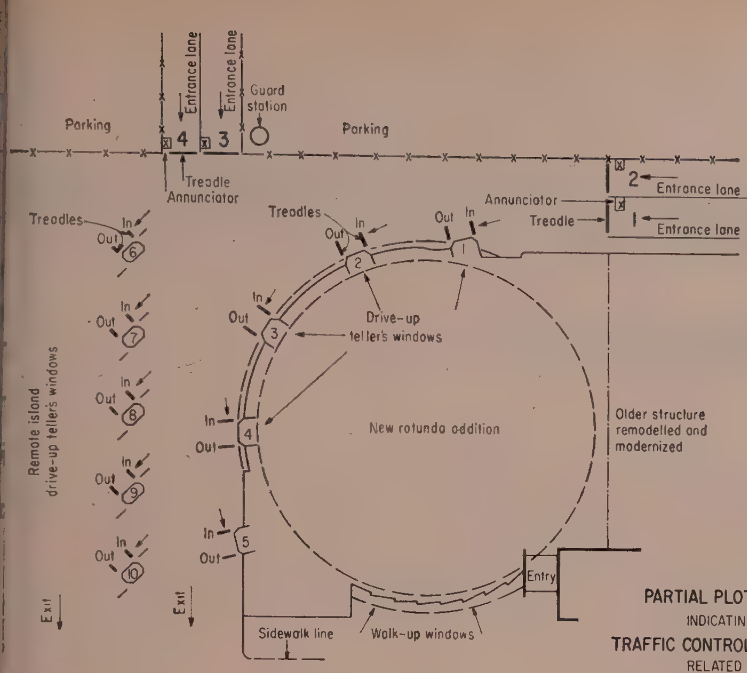
Should traffic at the northern entrance get to the point where it backs up into the street, all ten



FIVE SATELLITES, located remotely from main banking rotunda, are reached (by tellers) through underground tunnels and (by motorists) from any of four lanes related to two entrances on different city streets. Identification number above teller's window is illuminated when window is "available" for business; remaining unlighted when window is not occupied by teller, or is occupied by car. During non-normal conditions, any window can be bypassed automatically by the system, or the system can be bypassed by a teller using manual pushbuttons.



HUGE ROTUNDA enclosing main banking center contains five additional drive-up tellers' windows around periphery, each booth equipped with traffic treadles and identification numerals, closed-circuit TV and telephone, local lighting and power outlets for electric business machines, also pushbuttons to bypass automatic traffic control system under conditions discussed in article.



PARTIAL PLOT PLAN
INDICATING
TRAFFIC CONTROL FEATURES
RELATED TO
DRIVE-IN BANKING

N DRIVE-UP WINDOWS permit motorists to transact banking procedures without aving their cars, while intricate traffic control system efficiently directs movement autos entering banking area from four entrance portals. System incorporates use illuminated annunciators and window identification numbers, lane-flush treadles nd variety of relay-activated sequencing equipment.

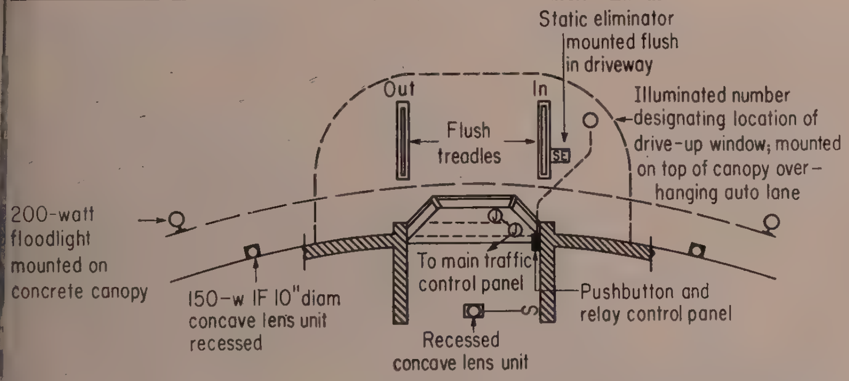
ILLUMINATED ANNUNCIATOR on driver's side of each incoming lane contains red signals and backlighted "wait" sign; also green signal which flashes while the motorist is directed to proceed to unoccupied teller's window, which is identified by illuminated number on annunciator. Subsequent movement of cars, in this or adjacent lane, is then halted until car in this lane proceeds through "merging traffic" area and crosses threshold treadle.

llers' windows would be made vailable to serve these lanes while rs waiting at the western enrance would be held until the mporary traffic jam is relieved. Conversely, when traffic is heavr in western lanes 3 and 4, cars in those lanes are directed to proceed to eight windows numbered 3 through 10 while cars at the north entrance are temporarily halted.

Traffic is directed automatically with red "wait" and green "proceed" lights. Stepping switches direct each vehicle to the next vacant window in rotation. "In" and "Out" treadles at each window cause the control to by-pass an occupied window and restore it to the normal sequence as it becomes available.

Manual switches are provided at each window which can cause the control to by-pass the window when it is unattended. Another manual switch permits the teller to by-pass the "out" treadle and line up his next customer while a transaction is still being completed. This feature is used when traffic is unusually heavy.

Control wiring used in the system is No. 16, carried underground between stations in rigid conduits. All connections to relays and control equipment are soldered.


Static eliminator mounted flush in driveway
Out
In
Flush treadles
SE
Illuminated number designating location of drive-up window; mounted on top of canopy over-hanging auto lane
200-watt floodlight mounted on concrete canopy
150-w IF 10"diam concave lens unit recessed
To main traffic control panel
Pushbutton and relay control panel
Recessed concave lens unit

TYPICAL
DRIVE-UP
TELLER'S WINDOW
STATION

Note: Installed but not shown above are outlets for closed-circuit TV set, telephone, electric adding machine, foot-switch "holdup" alarm and under-counter asymmetric-reflector fluorescent striplights.

TELLER'S WINDOW is incorporated into car routing sequence whenever the station s occupied. Station is included in system as soon as teller pushes button to illuminate identification number located atop ramp canopy. Window is temporarily removed from sequence rotation when a customer's car crosses the "in" treadle, then is reactivated when car proceeds over "out" threshold. In addition to traffic control anel, each booth is equipped with local lighting over counters, outlets for closed-circuit TV set and telephone, adding machine and "holdup" foot-switch alarm.

Other Features

In addition to the traffic control system each teller's station is equipped for local lighting over the counters, outlets for closed-circuit television equipment, telephone, adding machines and alarm devices.

The electrical wiring system and equipment for the traffic control system were installed by the Easter Owens Electric Co. of Denver, Colo.

Loop Conveyors Spee Motor Repairs

Compact shop layout at Dowzer Electric Machinery Works, Inc., Mt. Vernon, Ill., combines roller conveyors, overhead hoists and in-line work stations to slash handling time.

ELECTRIC motors literally roll through the redesigned repair department at Dowzer Electric Machinery Works, Inc., Mt. Vernon, Ill. Management's desire to improve operating efficiency led to a complete revamping of shop layout. Now, all motor repairs are concentrated in a 60- by 90-ft area where units from fractional to 1200-hp size are handled. To slash over-all repair time, Dowzer engineers established a smooth work flow incorporating conveyorized material handling carefully coordinated with repair operations. Backtracking and work transfer have been reduced to an absolute minimum. The net result is a more profitable operation, better customer service (motors are delivered quicker), and improved customer relations.

Key item in the new layout is the double-loop roller conveyor syste with in-line and parallel work st tions and supplementary overhe hoist rails. As indicated by the a companying plan and number photos, the conveyor line begins the disassembly area just ahead the first test station (Photo where motor trouble is diagnose This is the first leg of the "oute loop which carries stators and hea components past the in-line bur

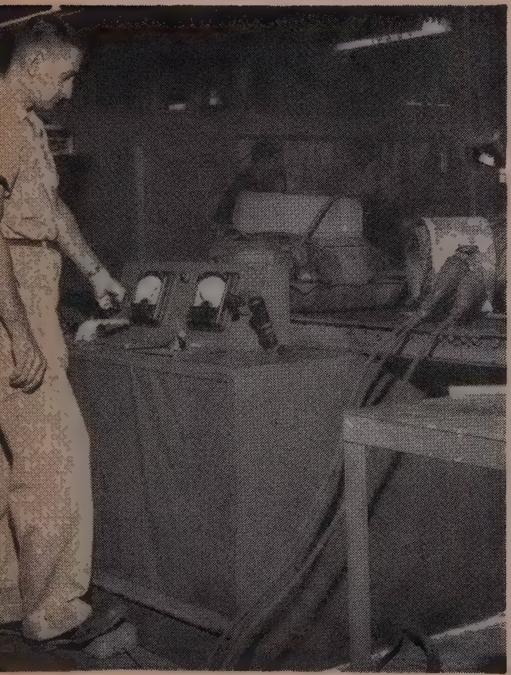
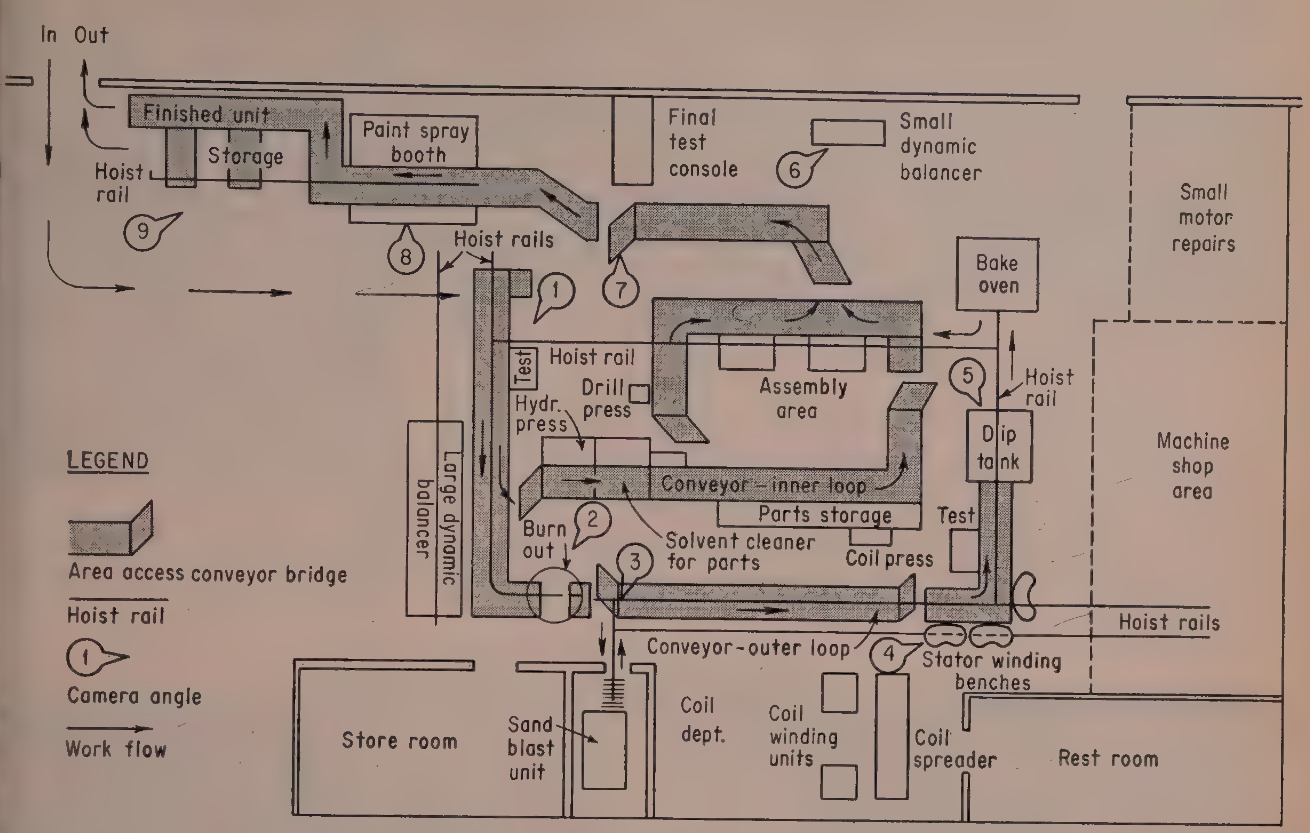


PHOTO 1—First test is at head of conveyor line where incoming motors are checked and disassembled. Parts continue along conveyors.

PHOTO 2—In-line burnout station where insulation on coils is charred. Stator on swivel pedestal is over gas jet. After coils are removed, stator goes to sand-blast booth, which is the next step in this production-line repair technique.



BASIC PLAN of compact, step-saving motor repair department at Dowzer Electric Machinery Works, Inc., Mt. Vernon, Ill. Shaded areas indicate roller-conveyor loops on which motors move through repair cycle. Work stations are either in line with, or parallel to, the conveyors.

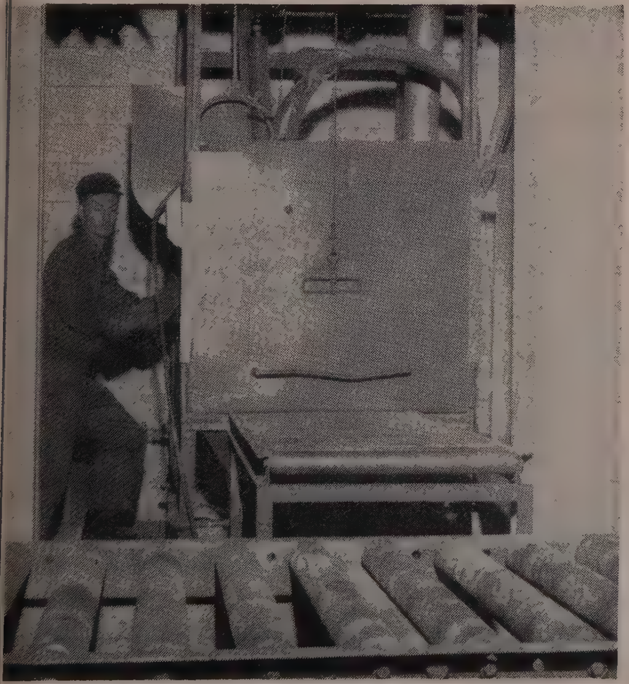


PHOTO 3—Sand-blast booth is in separate room across the aisle from burnout station; has lift-door at end fed by short conveyor stub. Jump from loop conveyor in foreground is made with overhead hoist.

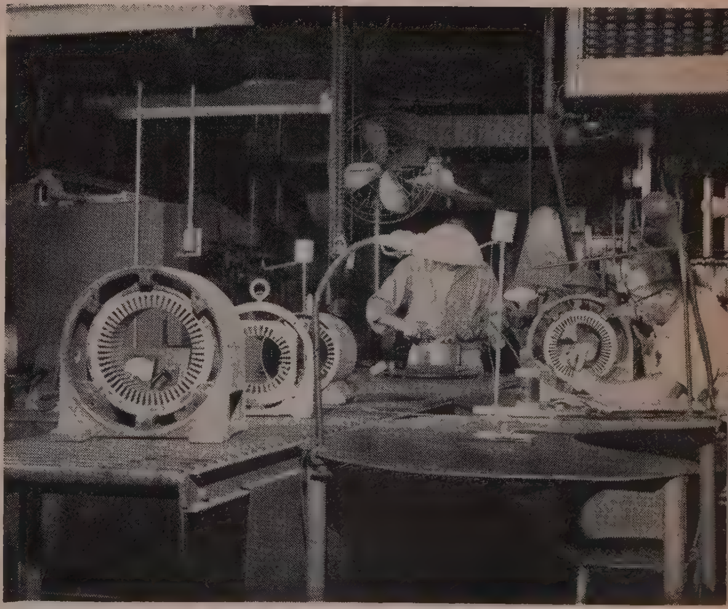


PHOTO 4—Stator winding benches have kidney-shaped steel tops that backup flush with outer loop conveyor which passes sand-blast booth. Second test station is just inside conveyor. Coils are formed in an adjacent area.

out station, sand-blast unit, coil winding department, stator winding area with its own test station, then on to the dip tank and bake oven.

The "inner" conveyor loop begins at a point midway between the first test and burnout stations. Here, small parts and components of a motor—in a tote tray—are shunted to the inner conveyor which circles the assembly area. After these parts are cleaned, repaired, or replaced at in-line stations, they meet the larger motor components coming out of the bake oven. Motors are reassembled at benches just inside the inner conveyor loop.

An overhead monorail hoist system, centered over the "outer" conveyor loop, provides supplementary handling facilities for exceptionally heavy or bulky equipment items. It also provides an effective "bridge" at such points as the sand-blast room, dip tank, bake oven and machine shop area.

After assembly, the repaired motors leave the assembly loop and ride a conveyor spur past the large test console (Photo 7) where final tests are made. After check-out, they continue through the paint spray booth to the finished unit storage area. At this point, the reconditioned motors are ready for pickup or delivery.

Dowzer management is well pleased with its new shop arrangement. The combination of modern equipment handling facilities with in-line work stations has eliminated many of the back-straining work transfer chores and provided a definite boost in over-all shop efficiency.

PHOTO 5—Dip tank breaks outer conveyor loop after it passes second test station in winding area. Hoist on overhead rail loads and unloads tank; transfers stators to mobile rack for in-line bake oven.

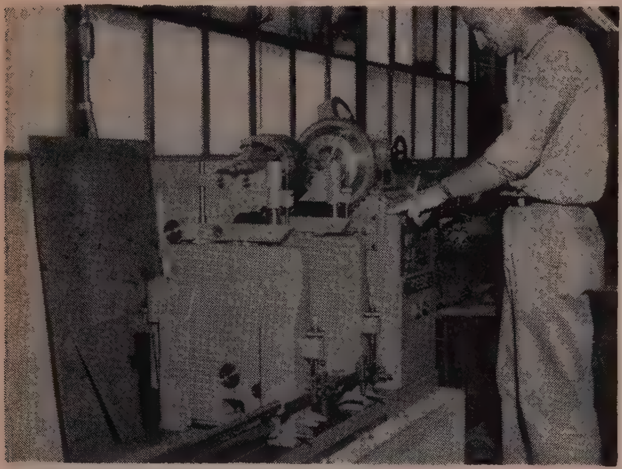


PHOTO 6—Small dynamic balancing machine is outside conveyor loop but handy to final assembly area. This unit has a 130-lb capacity; larger unit in shop has a 6,600-lb capacity.

PHOTO 7—Final test console is used to check assembled motors as they come along conveyor spur leading to paint spray booth and finished unit storage area.

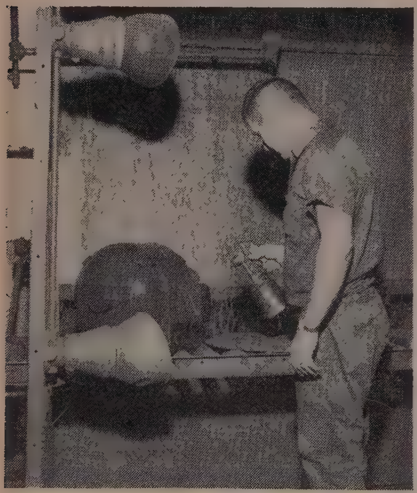
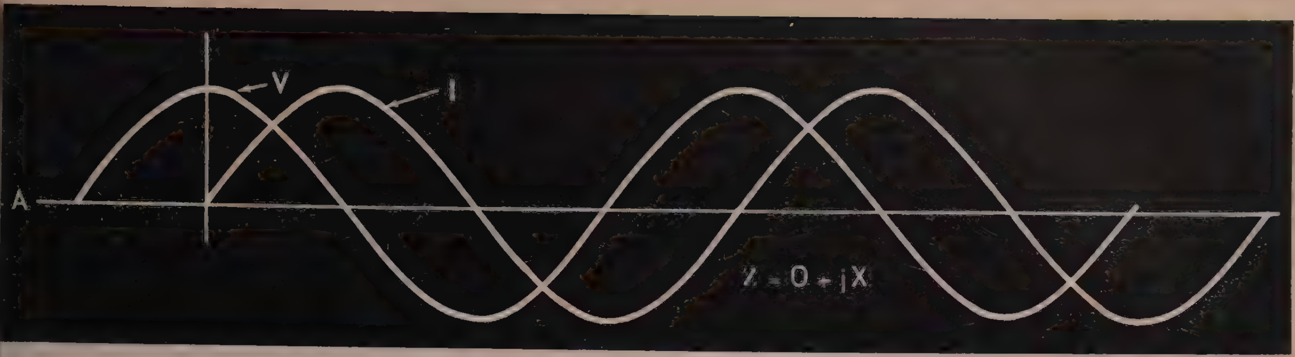


PHOTO 8—Conveyor line from final test station passes through front of paint spraying booth; has round swivel plate to permit rotating motor during spraying operation; continues on to storage area.

PHOTO 9—Finished unit storage area adjacent to spray booth has conveyor extension with spurs for storage or pickup; also overhead hoist. Motors can be stored either on conveyor or floor.



IG. 1—Symmetrical current is shown with relation to voltage when the resistance of the circuit is equal to zero.

Effective use of power CBs:

Know Circuit X/R Ratio

Check the X/R ratio of circuits to be protected by circuit breakers. It is important in selecting low-voltage circuit breakers for safe and efficient application.

By O. J. Albani, *Engineer, Boston Works, Allis-Chalmers Mfg. Co.*

THE NEMA Standards for Low-Voltage Power Circuit Breakers were recently modernized. The new interrupting ratings for this class of breaker are based upon symmetrical currents while the old standards were based on an asymmetrical current value. Application under the new standards will generally result in selection of the same breaker for the same circuit as the old procedure. Only the approach to the problem was changed—the result being simplified application.

In the years just prior to and during the modernization of the standard, the rating structure of the low-voltage power circuit breaker was reviewed by a technical committee. This group determined that at the 480- and 240-volt levels, the maximum interrupting ratings could be significantly increased without too much burden on the manufacturers. This uprating at the lower voltage levels was accompanied, however, by a corresponding simultaneous change in applicable X/R ratios from 11.72 to 6.6.

In the preparation of the AIEE Paper, "Short Circuit Currents in Low-Voltage Systems," by the NEMA Joint Sections Committee on Air Circuit Breakers, a detailed survey was made of all low-voltage breaker application areas, and it was determined that an X/R ratio of 6.6 appeared to be adequate for 95% of the applications. This proportional coverage of 95% was accepted as adequate to permit the changes in the rating structure and X/R ratio.

X/R Ratio Affects Breaker Ratings

It is well known that an R-L series circuit driven by a sinusoidal voltage is described in steady-state by Ohm's law ($I = E/Z$)

Where $Z = R + j\omega L$

If a short circuit should occur precisely at a point corresponding to normal voltage peak at current zero, the short-circuit current would be a symmetrical sine wave, as shown in Figs. 1 and 2. Systems faults are random, so one must also examine fault initiation at points in the voltage wave other than that which would produce a symmetrical sine wave of current.

Consider a case where the fault is applied at a time when the fault current would be maximum. An inductive circuit will not permit current to change magnitude instantaneously, so it cannot assume the peak value. The current will start from zero but have a symmetrical axis displaced from zero. An asymmetrical wave with respect to the normal zero axis is shown in Fig. 3. The symmetrical portion of the wave is still there, but the offset has added a dc component. The dc component in a power circuit will decay to zero, since there is no driv-

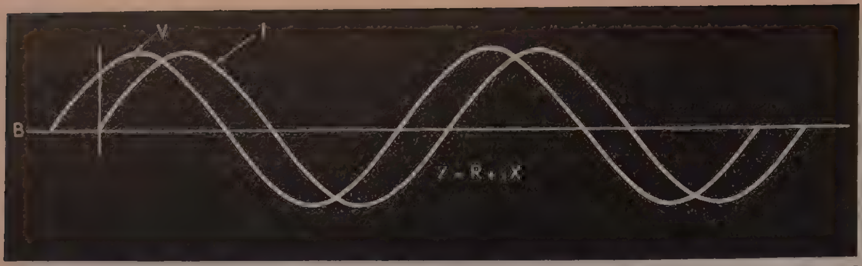


FIG. 2—Symmetrical current, shown with relation to voltage, takes the resistance of the circuit into consideration.

ing voltage to sustain it; and resistance, R, is always present which will dissipate the energy associated with the dc component. The rate of decay of the transient dc component is governed by the X/R ratio of the circuit. The large X/R (implying a low short-circuit power factor and a highly inductive circuit) indicates that the transient will decay slowly. If the transient did not decay at all, circuit with no resistance, the rms value of the fully asymmetrical wave would be 1.73 times the rms value of the ac component.

The new NEMA Standard for Low-Voltage Power Circuit Breakers has selected an X/R ratio of 6.6 for the test circuit. Under the conditions of X/R = 6.6, the dc component will decay so that the total rms value of a fully asymmetrical wave will be 1.33 times the symmetrical value when measured ½ cycle after fault initiation. In a three-phase system, each phase current will have a different degree of offset for a simultaneously applied fault. In a circuit having an X/R ratio of 6.6, the average of the three currents measured at the ½ cycle point will be 1.17 times the symmetrical value. Fig. 4 shows the relation of symmetrical, peak, maximum rms and average rms current of the 3-phase circuits with respect to X/R ratio and short-circuit power factor. The curves are plotted with short-circuit power as the base, range 0-50%, and show:

1. X/R ratio.

2. a. Peak value of current as a factor of the symmetrical value.

b. Maximum rms asymmetrical current as a factor of the symmetrical value.

c. Average rms 3-phase asymmetrical current, at the ½-cycle point, as a factor of the symmetrical value.

With various X/R ratios, or corresponding power factors, many multipliers would have to be used to express the variety of ratings. When these relations are taken care of in the test procedure, the application becomes simpler and straightforward.

X/R Ratio Limits Exceeded

In the past year, the NEMA Low-Voltage Breaker Technical Committee has been studying the area, approximately 5% of all low-voltage breaker applications, in which power system equipment exceeds the X/R ratio limits of the circuit breakers. In addition to a more detailed knowledge of this area of application, two alarming factors emanated from this study.

1. During a review of X/R ratios at an AIEE meeting of the Low-Voltage Switchgear Devices Subcommittee, it became apparent that many industrial application engineers have not given any consideration to X/R ratios of power systems in calculating and making low voltage system applications.

2. It is becoming common practice to apply "special high-impedance oil-filled transformers" having X/R ratio inherently higher than 6.6. The use of this type transformer apparently allows the application of lower symmetrical interrupting rating breakers if the X/R ratio limits are overlooked.

This overlooking of circuit limitations in breaker application is not usually in the best interests of either the users of this equipment or the manufacturers. To cope with this situation, the curve in Fig. 5 was prepared showing the effects of X/R ratios greater than 6.6. The multiplying factor in percent that should be worked into the calculations for proper application of low voltage power circuit breakers on the following typical circuits is given by the curve:

1. Local generation at circuit breaker voltage.

Where local generation is employed, it is not unusual to find generator X/R ratios ranging from 15 to 20 or even higher values. A conservative approach would be to assume an over-all X/R value equa to the generator value.

2. Dry-type transformers with high X/R ratios.

A poll of a half dozen NEMA manufacturers shows that averag dry-type transformers, both seale and ventilated, rated above 750 kv have X/R ratios in excess of 6. and ranging between 8 to 15.

3. Conventional high-impedanc transformers.

It can be assumed with little error that the over-all short-circui X/R ratio to the point of fault wi be the same as the inherent X/ ratio of this type of transformer.

4. Current-limiting busways o reactors.

Current-limiting busway circui

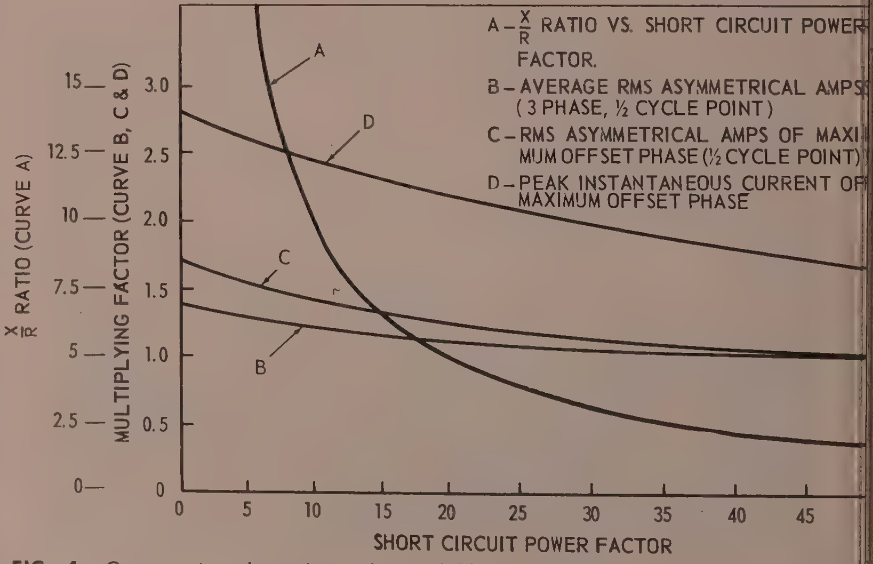


FIG. 4—Curves give the relationships of X/R ratio and variation of multiplyi factors to short-circuit power factor.

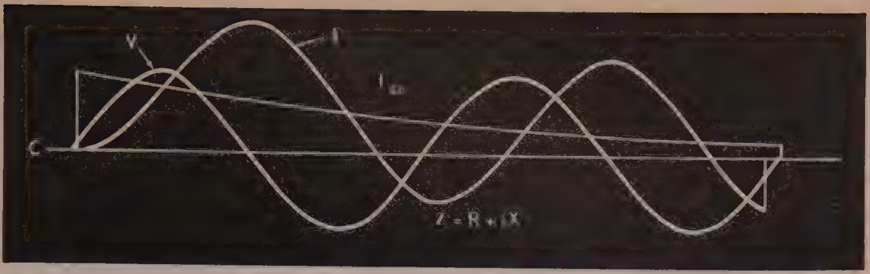


FIG. 3—Asymmetrical current relationship and decay of dc component is shown for circuit with X/R ratio of 6.6

have inherently high impedance to limit short-circuit currents. The X/R ratios for current-limiting busways range between 8 and 20 and current-limiting reactors between 8 and 12.

If the maximum available calculated symmetrical short-circuit current in these applications is greater than 85% of the symmetrical short-circuit current rating of the circuit breaker, a more detailed study of the X/R ratio should be undertaken. Multiplying factors that can be applied to the calculated symmetrical short-circuit current for applications where the X/R ratio is greater than 6.6 may be selected from Fig. 5. The product of this factor and the calculated symmetrical short-circuit current determines the symmetrical short-circuit current rating of the circuit breaker required.

In typical industrial power distribution systems employing liquid-filled transformers of standard ratings and impedance, between 5 and 5.75% impedance, the over-all short-circuit X/R ratio at the secondary unit substation may be taken to be that of the transformer alone. Thus for liquid-filled transformers 2000 kva and below, the X/R ratio will always be 6.6 or less.

Curve Determined

The X/R ratio of a circuit determines the rate of decay of the transient dc component of the available system short-circuit current. If the initial asymmetry and the X/R ratio are known, the magnitude of the short-circuit current at any instant can be calculated. In the case of maximum asymmetry in one phase, the dc component will be equal to the ac peak at t = 0, and will be:

$$I_{dc}\ (\text{at } t = 0) = 1.414 I_{ac}$$

The dc current, i_{dc}, will decay in an "RL" circuit according to:

$$i_{dc} = I_{dc} e^{-\frac{Rt}{L}}$$

This expression, for t = ½ cycle after inception of the short circuit is:

$$i_{dc} = I_{dc} e^{-\frac{R \frac{1}{120}}{L}}$$

$$= 1.414 I_{ac} e^{-\frac{377 \times \frac{1}{120}}{X/R}}$$

$$= 1.414 I_{ac} e^{-\frac{3.14}{X/R}}$$

For various system X/R ratios i_{dc}, will be:

X/R	i_{dc}
6.6	$i_{dc} = 1.414 I_{ac} e^{-\frac{3.14}{6.6}} = 0.878 I_{ac}$
11.72	$1.08\ I_{ac}$
15.	$1.145 I_{ac}$
20.	$1.210 I_{ac}$
25.	$1.245 I_{ac}$
100.	$1.371 I_{ac}$

Substituting the values of i_{dc} in the following formula:

$$I_{rms} = \sqrt{(I_{ac})^2 + (i_{dc})^2}$$

X/R		I_{rms}/I_{ac}
6.6	$I_{rms}/I_{ac} = \sqrt{1 + (.878)^2}$	= 1.33
11.72		= 1.47
15.		= 1.52
20.		= 1.57
25.		= 1.6
100.		= 1.73

The foregoing multiplying factors may be used to determine the asymmetrical, or rms resultant, current from the symmetrical calculated values of current for various system X/R ratios.

The method of calculating and compensating for variations in system X/R ratios outlined is the preferred method. A second possible method may be used as follows:

For application of breakers on systems which have X/R ratios larger than 6.6, the breaker rating may be corrected by a percent rating factor which will reduce the rated symmetrical interrupting current such that the same rms asymmetrical resultant current will occur at t = ½ cycle as in a circuit with X/R = 6.6. This factor is:

$$\text{Rating Factor} = \frac{I_{ac}(X/R > 6.6)}{I_{ac}(X/R = 6.6)}$$

$$= \frac{1.33}{\sqrt{1 + \left(\sqrt{2}\, e^{-\frac{3.14}{X/R}}\right)^2}}$$

This indicates that a breaker must have its symmetrical rating reduced when it is applied on a circuit with X/R greater than 6.6, to account for the higher asymmetrical current it could be called upon to interrupt. Another way to arrive at the factor above is to assume equal asymmetrical interrupting ratings for a breaker operating at 6.6 X/R ratio and at some greater X/R ratio and find the symmetrical ratings which correspond to the conditions. Then the ratio of the symmetrical ratings will indicate the factor for reducing the symmetrical rating from what it is at X/R = 6.6 to what it is at X/R = some value higher than 6.6. Given:

I_{rms1} = asymmetrical current with X/R = 6.6
I_{rms2} = asymmetrical current with X/R greater than 6.6
I_{ac1} = symmetrical current with X/R = 6.6
I_{ac2} = symmetrical current with X/R > 6.6

(Continued on page 211)

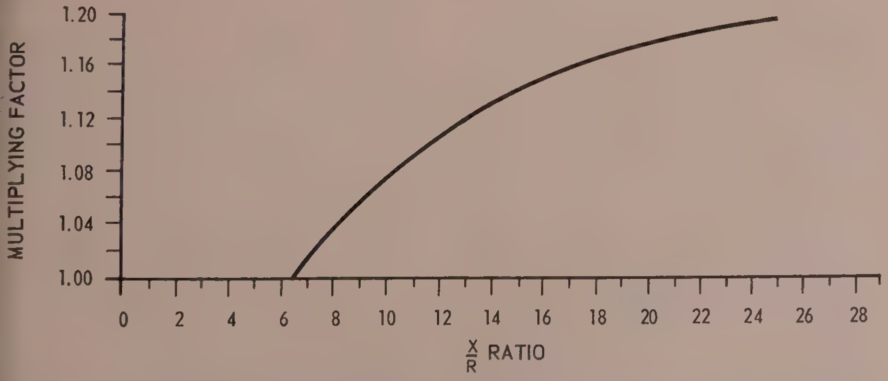


FIG. 5—Multiplying factors are given for calculated short-circuit currents having X/R ratios greater than 6.6

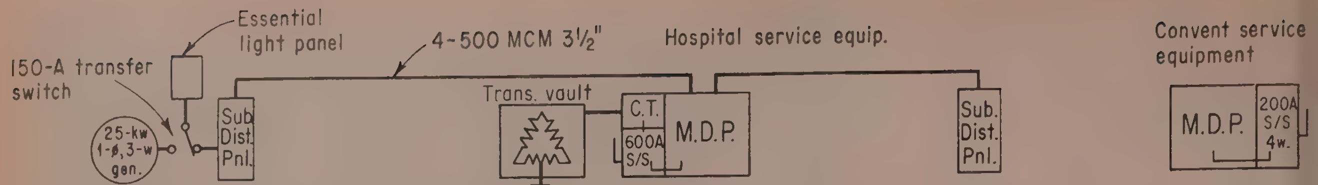


FIG. 1—Original electrical service and emergency layout for the hospital.

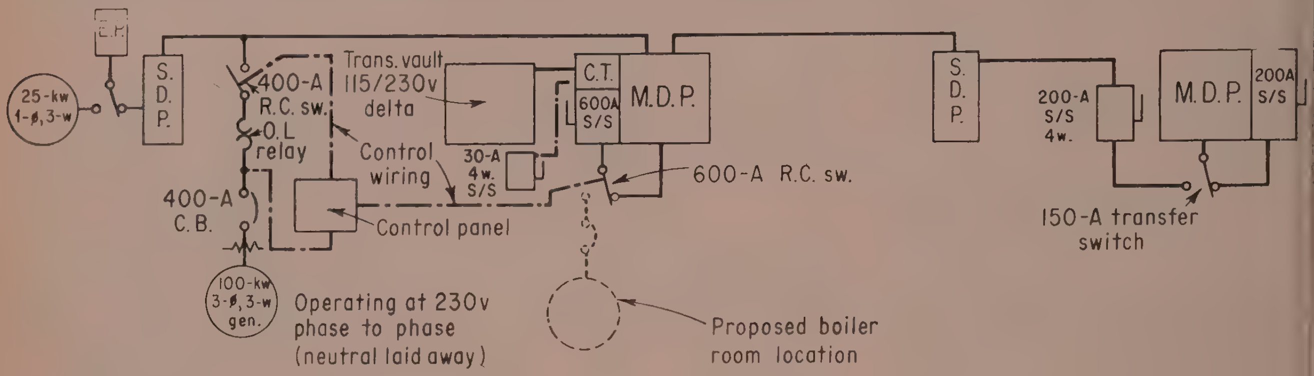


FIG. 2—Interim layout of the hospital supply system.

Long-range plan for . . .

Hospital Emergency Power

Here's the step-by-step procedure in development of a modernized hospital electrical system with expanded emergency power for essential loads.

By Robert A. Kelly, *Electrical Engineer, Brooklyn, N. Y.*

SEVERAL years ago, St. Francis Hospital for the care and treatment of cardiac and rheumatic patients, Roslyn, L. I., faced a serious problem over power interruption during the hurricane season. The only available emergency power was a 25-kw, 120/240-volt, single-phase diesel-powered generator. This unit was connected through a transfer switch to the operating suite and took care of the lighting and miscellaneous power requirements.

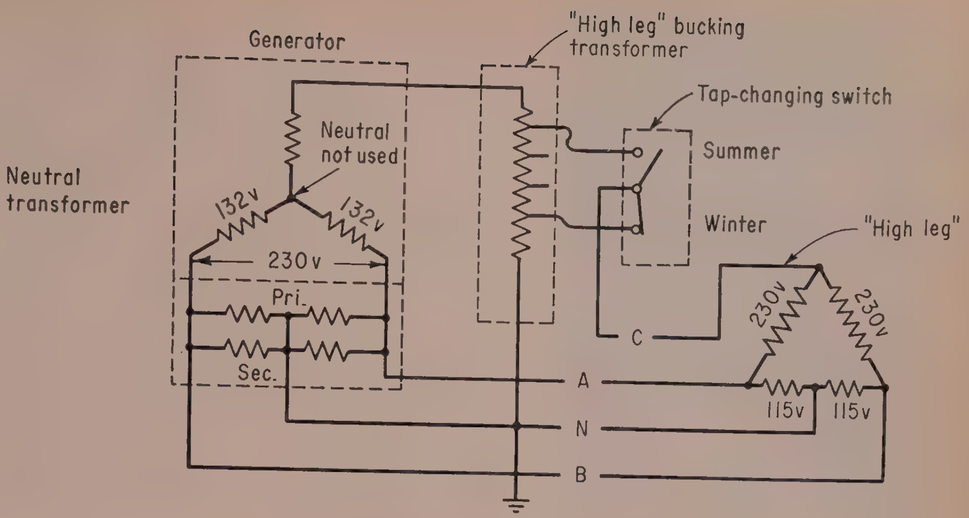
When an outage occurred, the three elevators stopped, all the refrigeration went off, the oil burners shut down, the air-conditioned oxygen tents and other special equipment for critical cases stopped operating, and most of the food preparing equipment became useless. Needless to say, it was almost impossible to operate a modern automated hospital without electric power. Most important, however, were the requirements to be met in keeping the patients calm and comfortable.

After a particularly long outage of three days, during which many temporary connections were made to the existing generator, it was decided that an emergency generator would have to be installed with sufficient capacity to run the entire plant, hospital, lavatories, chapel, convent and elevators.

The hospital was originally fe from three transformers, connecte wye-delta, giving 115/230 volts fo lighting plus a "high leg" fo 230-volt 3-phase power (Fig. 1) The peak demand, determined b the summer air conditioning wa around 50 kva, plus 14 kva for th chapel and convent, which were fe from the local secondary networ Since this network was supplie from the same primary as the transformers, there was no point in expanding the convent service to serv as an alternate source.

The hospital service was roughl in the middle of the plant, with th operating room and emergency generator at the extreme west end

FIG. 3—Wiring diagram of the connections used to match the wye-connected generator to the load which was fed by the delta-connected service transformers under normal conditions.



The boiler room, adjacent to the service, seemed to be the ideal spot to locate a new generator, since fuel tanks could be easily installed in the neighborhood of the existing ones, a very short feeder would be required, plenty of fresh air was available, and the noise factor in relation to the patients was favorable. The only other available spot was in the vicinity of the existing generator, but the cost of a 400-amp feeder to the electric service through a very long crawl space was high.

In order to determine what size generator would be required, a recording ammeter was connected to the service conductors for a period of several weeks to get an idea of the nature and division of the load on the various phases. By comparing the curves obtained with the demand and load figures over a period of years, we determined that a 100-kv unit would be both adequate and economical—economical considering the budget, and adequate considering the approximate rate of growth and existing load.

But, the boiler room location had to be abandoned because of insufficient space and because of the amount of labor required to get the equipment through the concrete foundation. This brought up the problem of the feeder, since the new generator would be located near the existing one.

After some further study, we decided to "split" the automatic transfer switch and use an existing 400-amp feeder as a tie between the two "pieces" (Fig. 2). By using a 600-amp switch at the service (required by the code since the existing service switch was 600 amps) and a 400-amp switch at the new generator (minimum permissible size), savings were made over the use of a full 600-amp transfer switch. Electrically operated mechanically held remote control switches were used in conjunction with a control center containing phase failure relays, a transfer relay with engine-starting contacts, and the necessary equipment to give full electrical interlocking between the two remote control switches. The control center was a standard item modified according to our instructions to meet the power company's requirements.

The remaining problem was the method of matching a generator to the delta electrical system. A delta generator would not be fully utilized due to the large single phase component of the load. Since the 600-amp electrical service would sometime have to be expanded, it was decided to purchase a 120/208-volt, wye-connected unit and match it by some means to the load.

The possibility of operating the hospital and convent on 120/208-volt wye was eliminated by the fact that the elevator manufacturer advised us that the elevators would not operate properly on two different voltages because of the brake solenoids and motor thermals. The cost of auto-transformers and switching equipment for three elevators was not economical. Boosting the generator output to 230 volts (instead of 208) was ruled out because the lighting circuits would be operating on 132 volts.

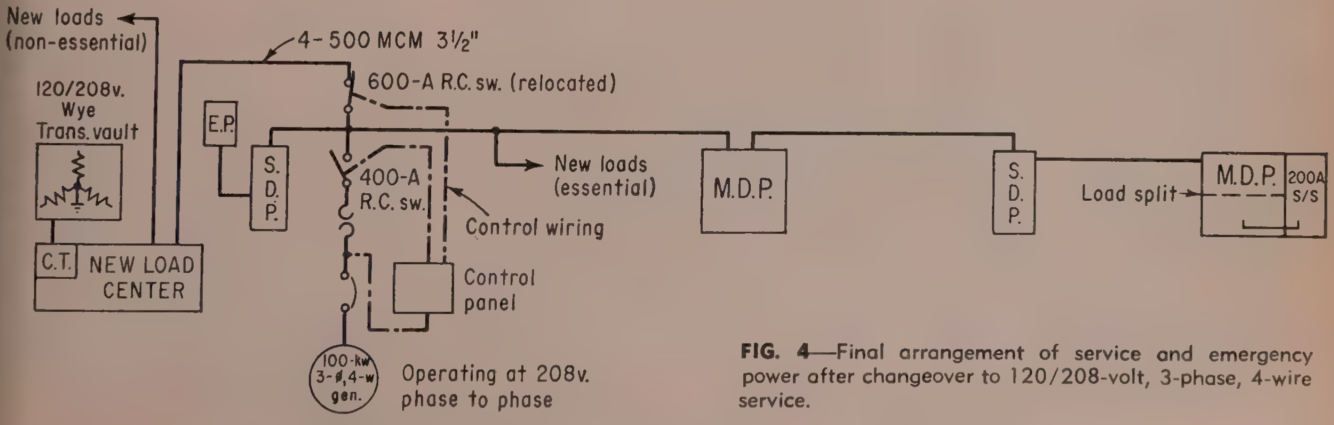
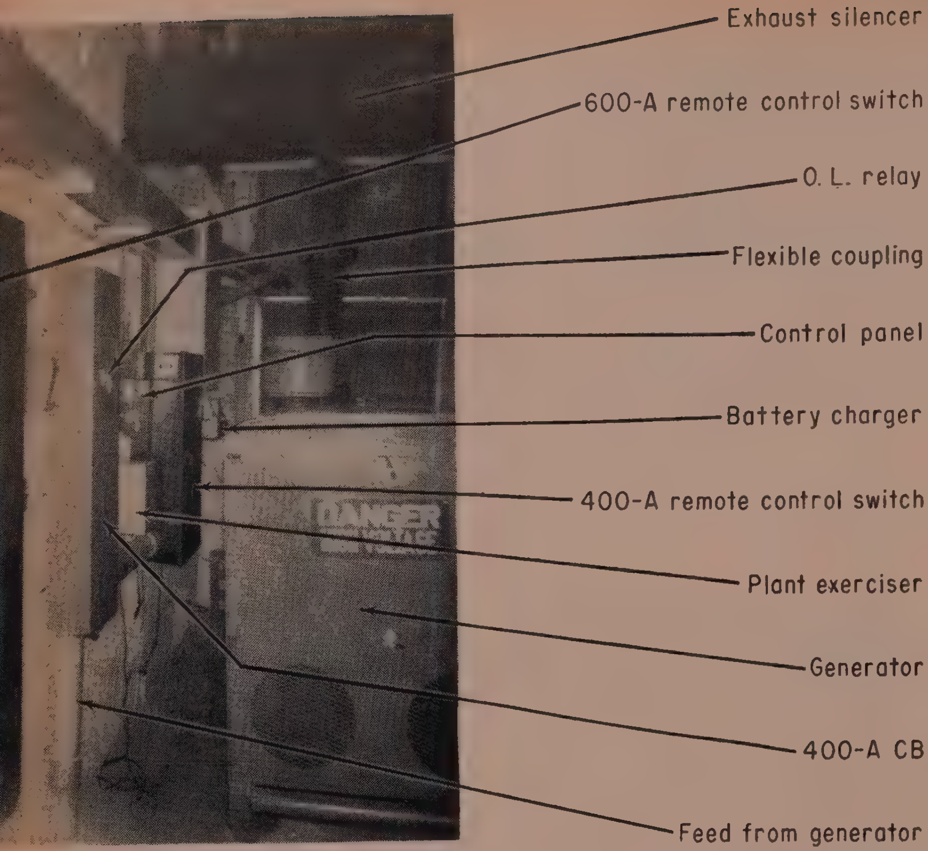


FIG. 4—Final arrangement of service and emergency power after changeover to 120/208-volt, 3-phase, 4-wire service.



EQUIPMENT LAYOUT adjacent to the new 100-kw generator unit is made along the wall, as shown. The 600-amp remote-control switch (extreme left) was relocated here from its position at the old main service location (see Fig. 2).

Economic factors eliminated the use of 33-kva transformers connected wye-delta because of the low utilization factor and because they would be discarded at a future date.

We noted the fact that the generator exciter had sufficient range to enable us to operate the unit at 230 volts because the full capacity of the generator would not be used for some time. Accordingly, the unit was connected directly to the line using only the phase legs, and a neutral was derived by means of a transformer connected between the phases to be used for lighting. This was 33 kva, 120/240 volts, which would carry a neutral current load of 277 amps with the primaries and secondaries connected in parallel. The generator neutral was taped up and laid away for future use.

We submitted our proposal and estimate, and included the reasons for the various arrangements of equipment, and what could be expected in the future from the installation. A contract was drawn up and we proceeded with the purchase of the generator.

The convent and chapel were connected to the existing hospital service by means of a feeder and transfer switch. In case the local secondary service went out, the convent would automatically switch over to the hospital service which would be backed up by the new generator. Interestingly enough, one night the convent's service fuses blew and the utility company was very puzzled when there was apparently no power consumed for a period of three months. Pro-rated bills were sent for the interval "until the meter could be repaired." It was all readily adjusted when they received an explanation.

The installation of the generator went very smoothly. Conduits for power and fuel were installed prior to pouring the concrete base on which the frame would rest. Vibration eliminators were used to prevent transmission of vibration to the building and a flexible coupling was installed in the diesel exhaust connection to de-couple motion of the unit from the silencer type muffler. The exhaust pipe was run outside to the roof with as few bends as possible to eliminate any back pressure.

A basement window was enlarged and a duct with a pneumatic damper was connected to the diesel's radiator to supply cooling air, which would be pulled in by the fan. The damper closed when the unit was not in use. Anti-freeze was added to the radiator for safety's sake. Industrial-type starting batteries were furnished in accordance with the code, along with a suitable trickle charger. The fuel supply was tapped from the existing feed to the other generator and all that was left was to turn it on.

On a quiet Saturday morning, a simulated power failure was held. After the required time delay, the diesel roared into life, the lights went on and everything seemed fine. A voltage check was made and we abruptly terminated the test. The "high leg," with very little load, was operating at 250 volts to ground when it should have been 199, with the resulting phase voltages in the neighborhood of 280-300 volts. In the short time the generator was in operation, all the 3-phase motors had tripped out on overload.

The problem was investigated and it turned up the simple fact that an alternator usually has a regulation or internal impedance of 25-30%. To overcome this, a voltage regulator is added to the exciter so that when the load changes, the output voltage remains constant. This system includes the assumption that the load is evenly distributed on all phases. In this case the regulator was maintaining 230 volts between the lighting phases which were equally loaded due to the neutral transformer, but the voltage drop which would ordinarily appear on these phases without a regulator, appeared as a voltage rise on the lightly loaded phase because of regulator action.

Since there was no way of balancing the load without changing th many single phase feeders and panels to 3-phase, a step-down transformer of small capacity and multiple taps was inserted in the high leg to bring the voltage down to normal (Fig. 3). Because of th difference between summer an winter load, a double throw "Summer-Winter" switch was added to assist in tap changing. When thi equipment was installed, the emergency generator worked beautifull until there was a genuine outage. When the power was really neede the new unit would run for a fe minutes and then die.

(Continued on page 213)

Auxiliary Annunciation for Fire Alarm Systems

A simple relay device, connected into a conventional fire-alarm system, solved a difficult wiring problem at the Hanford Atomic Products Operation, General Electric Co., Hanford, Wash.

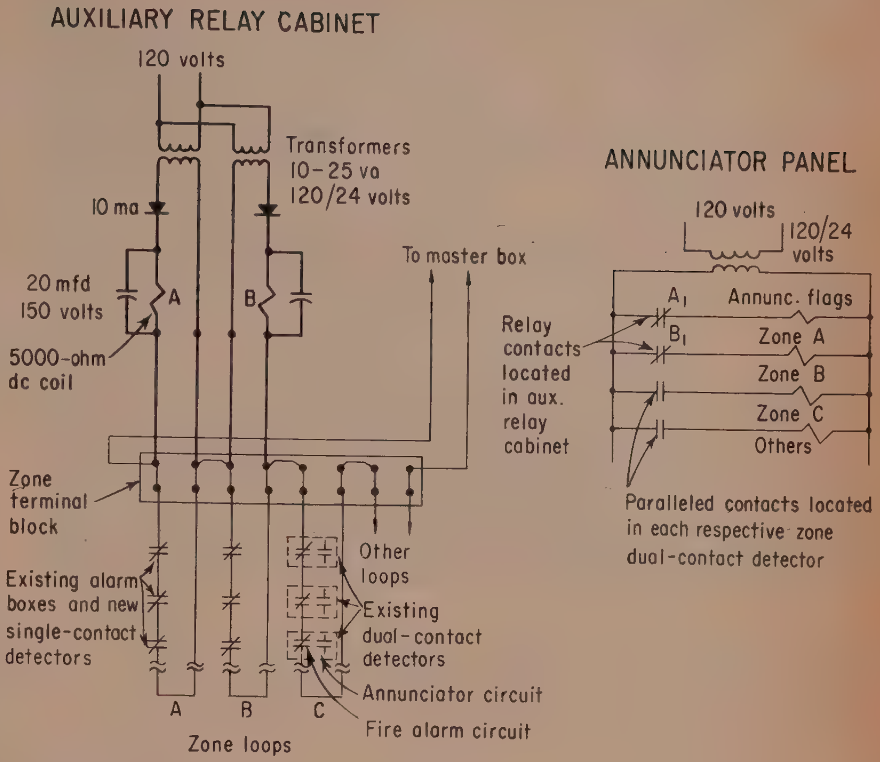
Corrosive vapors had damaged 81 detection heads, which were furnished with dual contacts providing for fire annunciation as well as alarm. They were not, however, resistant to a corrosive atmosphere that occurs in parts of the fuel preparation department.

When planning to replace the damaged detectors with non-corrosive, equally versatile heads, T. D. Gibbs, engineer, plant facilities, found that the detection heads available could not meet the system requirements. The problem was solved, however, by development and installation of an auxiliary relay device and unique circuitry incorporating stainless-steel, single-contact detectors, which will provide both annunciation and alarm.

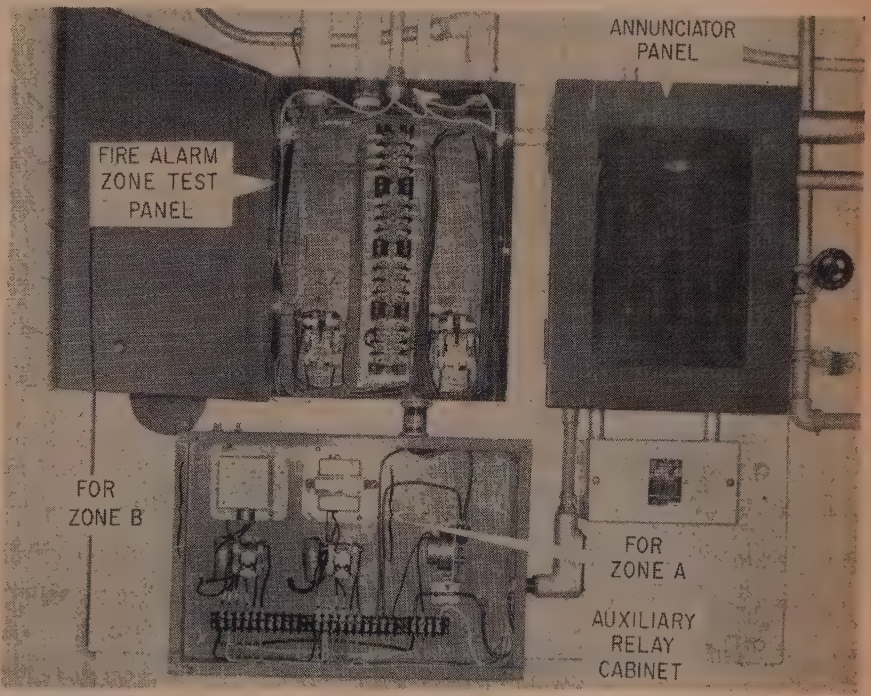
The building where the detector-head trouble developed is equipped with a fire-alarm system consisting of a master box, a supervisory panel, an annunciator panel, a zone test panel and a shunt loop consisting of 252 dual-contact detectors and six auxiliary alarm boxes. The building, in which fuel elements for irradiation in Hanford's giant plutonium-producing atomic reactors are produced, is divided into zones. Each zone is annunciated if a detector or box in that zone is actuated. Two zones were affected when the 81 heads corroded.

To prevent recurrent corrosion, stainless-steel clad detectors were selected to replace the corroded heads. Stainless-steel detectors are ideal from the corrosive standpoint; however, units that met requirements were available only with single contacts.

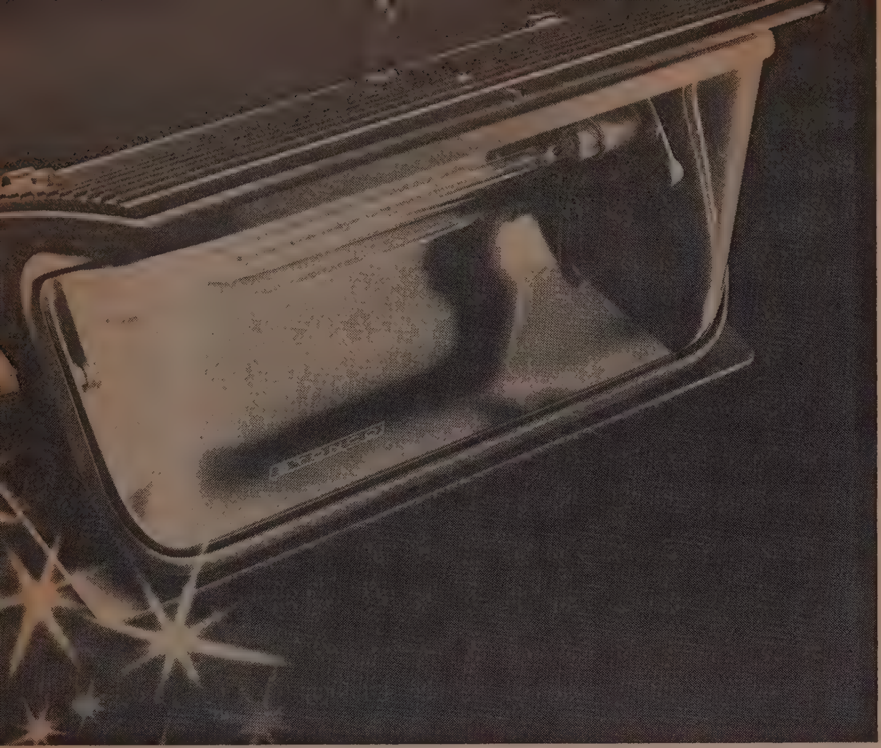
The existing detectors have two contacts, one NC for use in the shunt fire-alarm circuit and one NO for annunciation. In order to take advantage of the non-corrosive feature and to maintain the desired annunciation, it appeared that it would be necessary to use two stainless-steel, single-contact detectors at each detector location—one with NC contacts for the fire-alarm circuit and one with NO contacts for



WIRING DIAGRAM shows how circuit operates. Auxiliary relay coil A will hold open contacts A_1, which are connected in the annunciator circuit. If an alarm box or a single-contact detector in zone A is actuated, the relay contacts A_1 close energizing the annunciator audible signal and respective flag. Resistance of auxiliary annunciation relay circuitry is so high (5000 ohms) in comparison to the zone loop resistance (less than 30 ohms) that it cannot interfere with normal fire-alarm operation.



AUXILIARY RELAY CABINET is conveniently mounted beneath zone test panel. Components of an auxiliary relay device are a 25-va, 120/24-volt transformer, a 10-ma half-wave rectifier, a 25-mfd, 150-volt filter capacitor, and a relay with a 5000-ohm dc coil and normally closed contacts. Auxiliary relay devices allow single-contact detector heads to provide for both fire annunciation and fire alarm.



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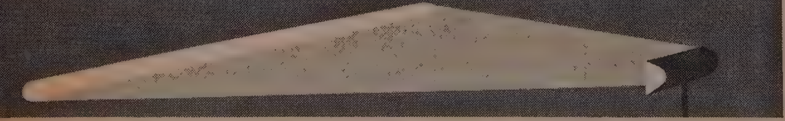

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annunciation. This course is feasible and is used in the plant in a few instances; however, it is doubly expensive involving twice the number of heads and additional installation labor. Moreover, local Fire Department officials do not recommend this kind of installation because there can be no assurance that the paired fire-alarm and annunciator detectors will actuate simultaneously.

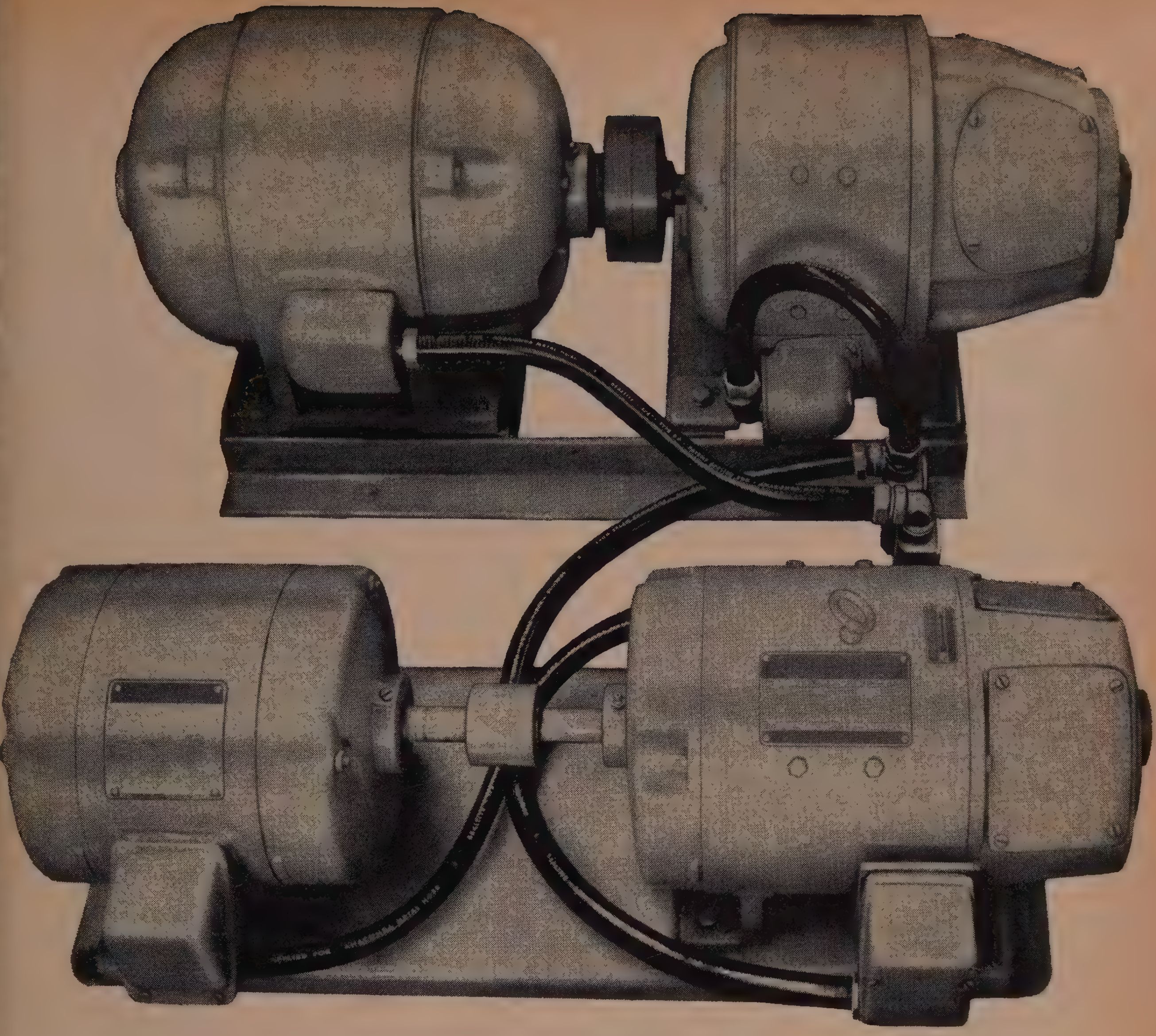
Therefore, an auxiliary relay device was developed which allowed use of only one stainless-steel detector at each former detector location in the two zones subject to corrosion. Because the leads of each zone loop are carried to a fire alarm loop test panel equipped with a terminal block, it was quite convenient to assemble one relay device for each loop involved, mount these in an appropriate cabinet adjacent to the test panel and connect to the respective zone loop terminals.

Circuit Operation

Components and circuit operation are shown in the accompanying diagram. In zone A, normally closed contacts of detector heads and alarm boxes serve as actuators for auxiliary relay A. Current flows from the transformer secondary through the rectifier, the relay coil, zone A detector contacts and box contacts and back to the other side of the transformer. The filter capacitor across the relay coil removes ripple and effects sufficient voltage to actuate the relay. Normally closed contacts A_1, connected in the annunciator circuit, are now held open. If a detector or alarm box in zone A is actuated, relay A deenergizes, and contacts A_1 close to energize the annunciator audible signal device and respective flag. At the same time, the master box trips sending in an alarm to the central fire station.

The resistance of relay A coil is so high (5000 ohms) compared t the zone loop resistance (total resistance of the entire shunt loo cannot exceed 30 ohms) that th auxiliary relay device cannot interfere with normal fire-alarm operation.

The accompanying photo show the fire alarm loop test panel, th annunciator panel and the cabine with the components of the auxiliary relay device for zones A and B In this instance, only two zone were involved, requiring only tw devices. However, as many device could be used as there are zones t be annunciated.



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	Trade Size (In.)	INSIDE DIAMETER		OUTSIDE DIAMETER		Approx. Inside Bend Diam. (Inches)	Feet Per Std. Coil	Approx. Shipping Wgt. (Lbs.) Per Std. Coil	Feet Per Std. Reel	Approx. Shipping Wgt. (Lbs.) Per Std. Reel
		Min.	Max.	Min.	Max.					
TYPE UA	⅜	.484	.504	.690	.710	6	200	60	1500	460
	½	.622	.642	.820	.840	7	200	70	1000	365
	¾	.820	.840	1.030	1.050	10	150	70	850	420
	1	1.041	1.066	1.290	1.315	13	100	90	600	525
	1¼	1.380	1.410	1.630	1.660	16	50	70	375	430
TYPE EF	⅜	.485	.505	.690	710	4	250	60	1500	390
	½	.620	.640	.820	.840	5	200	60	1000	325
	¾	.815	.835	1.030	1.050	6	175	70	850	375
	1	1.030	1.055	1.290	1.315	8	100	60	600	420
	1¼	1.370	1.395	1.635	1.660	9	100	80	375	360
	1½	1.575	1.600	1.875	1.900	11	50	55		
	2	2.020	2.045	2.350	2.375	14	50	75		
	2½	2.480	2.505	2.850	2.875	19	50	105		
	3	3.070	3.100	3.470	3.500	23	25	80		
	4	4.000	4.040	4.460	4.500	28	25	105		

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Bank Modernization Features 170-FC Lobby Lighting

Wasatch Electric of Salt Lake City can take a bow for their installation of lighting and air conditioning equipment in the modernized Walker Bank and Trust Co.

Ranking as a "conversation piece" around town, the luminous ceiling above the bank's remodeled lobby consists of 6300 sq ft of corrugated Plexiglas sheeting translighted by a thousand 4-ft rapid-start fluorescent lamps operating at 430 ma to provide 170 fc to customer check-writing desks at center floor and 135 fc to areas behind tellers' counters, where intensities are somewhat lessened by wood-paneling light-absorption. In addition, 150 linear ft of cove lighting introduces an additional decorative motif, results being high-level, shadowless, comfortable illumination with reasonable brightness values and minimum glare.

Lighting is switched directly from 480/277-volt control panels, power for the bank space only being obtained from three 167-kva dry-type transformers.

Due to prefixed positions and widths of existing structural columns (noted at right of accompanying photo), it was impossible to maintain a standard ceiling panel pattern; therefore, corrugated strips vary in width from 25 to 28 in. Variations are so gradual as to remain undetected by casual observance, however. And, by suspending rows of lamps 18 in. on centers and 18 in. above translucent paneling, over-all brightness is quite uniform.

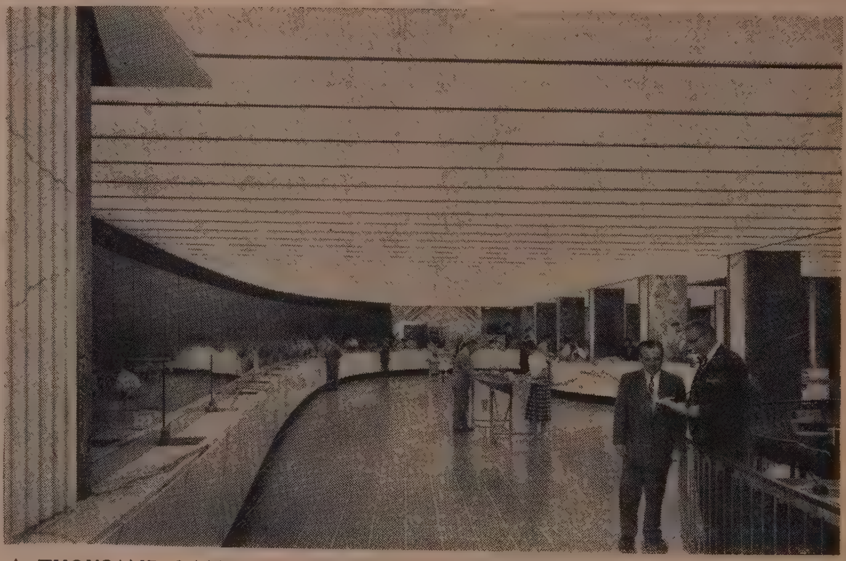
T-bar framing for paneling and lamp channels alike are suspended from the same basic lipped-channel framework, while the bright appearance of the installation is maintained by group lamp replacement and panel washing programs.

In a separate section adjacent to this main lobby section, interview desks of bank officials are lighted to a 50-fc level by means of recessed square lensed units (64 in all) containing 300-watt incandescent lamps.

Modernization of the building also included complete air conditioning. One system supplies the bank and first three floors. A second installation serves the remainder of this 16-floor property.

Of these two systems, the bank installation consists of a 100-hp compressor, with chilled water circulated to air handling units by means of thermostat-activated pumps. For upper floors, forced air is first cooled by two 125-ton cooling towers combining a 15-hp water circulating pump and two 7½-hp air circulating fans. Then air is electrostatically filtered; washed by water screen; recooled and humidity-regulated by refrigeration coils in a 40-hp compressor; distributed to various floors by twin 5- and 4-ft-sq partitioned ducts installed up the outside (rear) of the building; and directed to various offices by a 25-hp 10-ft fan in accordance with requirements of four separate zones corresponding to exterior exposure of the building.

Local air supply is via plenums installed above suspended acoustically tiled corridor ceilings, while



A THOUSAND LAMPS and 6300 sq ft of translucent paneling provide unity and impression of cheerful outdoor expansiveness in this modernized bank lobby where illumination levels reach 170 fc. This 16-floor building in Salt Lake City was additionally modernized by installation of total air conditioning.

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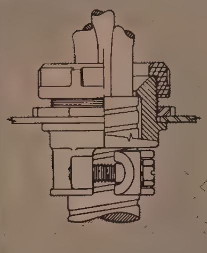
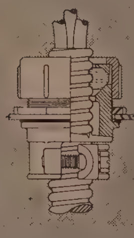
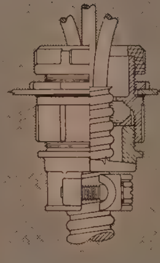
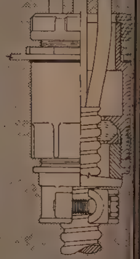
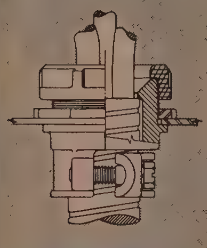
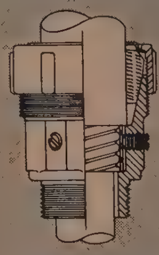
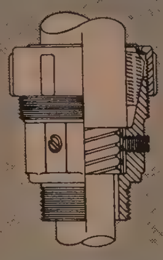
NON-JACKETED INTERLOCKED ARMORED CABLE	 **TYPE PK**	 **TYPE PKG**	 **TYPE PKS**	 **TYPE PK**
NON-JACKETED CONTINUOUS ARMORED CABLE	 **TYPE PK**	 **TYPE CPKG**	 **TYPE CPKS**	 **TYPE CPK**
INTERLOCKED & CONTINUOUS JACKETED ARMORED CABLE	 **TYPE PK**	 **TYPE PG**	 **TYPE PG**	 **TYPE SP**

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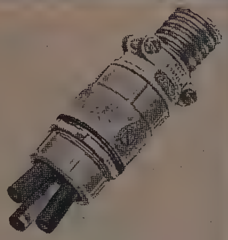
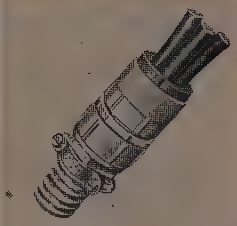
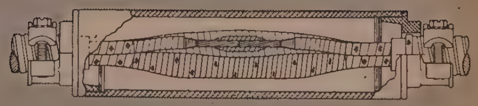
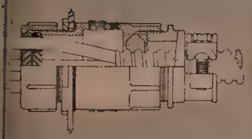
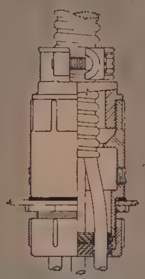
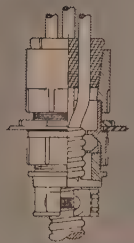
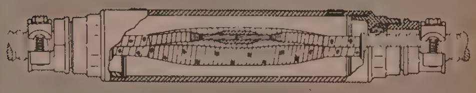
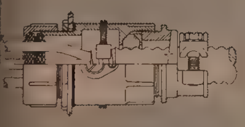
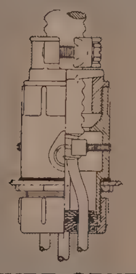
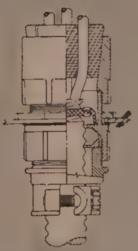
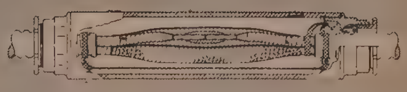
 TYPE PKH	 **TYPE PKT**	 **TYPE PKR**	**PKJV-1**  Non-Watertight: 600V Varnished Cambric Insulated Interlocked Armored Cable.
 **TYPE CPKH**	 **TYPE CPKT**	 **TYPE CPKSR** **(WATERTIGHT)**	**CPKJV-5**  Watertight: 5KV (Max.) Varnished Cambric Insulated Continuous Armored Cable.
 **TYPE SPKH**	 **TYPE SPKT**	 **TYPE SPKSR** **(WATERTIGHT)**	**SPKJV-15**  Watertight: 15KV Shielded Varnished Cambric Insulated Interlocked or Continuous Armored Cable.

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Credits for modernization go to Wasatch for all electrical installation work related to the bank's relighting and air conditioning program; to Blomquist and Brown, electrical consulting engineers; to Ashton, Evans and Brazier, architects; and to Central Electric for installing power wiring for air conditioning of upper floors.

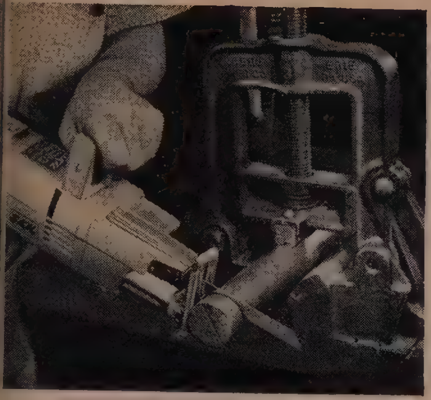
Special Enclosure Designed for Remote Housing of Ballasts

In a new Portland, Ore. department store, centrally located escalators are illuminated by ceiling-recessed 3-lamp 277-volt fluorescent units. Each floor requires 16 such units; half is installed above "up" and half above "down" stairwells. Half of the units is mounted on flat and half on sloping ceiling surfaces, with half of each bank being circuited through "normal" and "emergency" branch circuits.

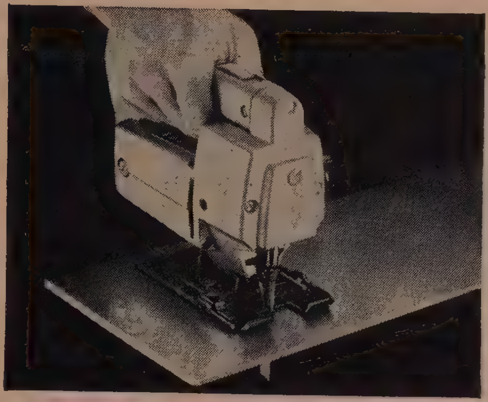
Ballasts for these fixtures are located remotely, in specially constructed sheet steel enclosures mounted on walls of central floor electric rooms. Enclosures obtain ample ventilation through expanded-metal panels on fronts, sides, tops and bottoms. And, in addition, panels are mounted several inches away from walls to further ventilate and isolate vibration transmission to walls. Panels are secured to concrete block walls by means of anchor bolts, while short sections of conduit are placed around the bolts to define the desired spacing of the air gap. It may also be noted that each enclosure is vertically partitioned with a steel dividing section which serves to isolate ballasts variously related to normal and emergency circuitry. Each ballast connects with its related 3-lamp fixtures via five No. 12 AVA wires contained in $\frac{3}{4}$-in. conduit.

As indicated by diagram, normal power serving all circuits is obtained from this main 277/480-volt switchboard, with emergency circuits, rated at 120/208 volts, served through auxiliary dry-type transformers as required.

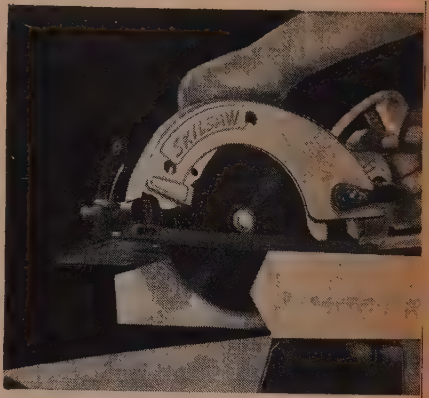
9 Do you know about these NEW SKIL Power Tool Ideas?



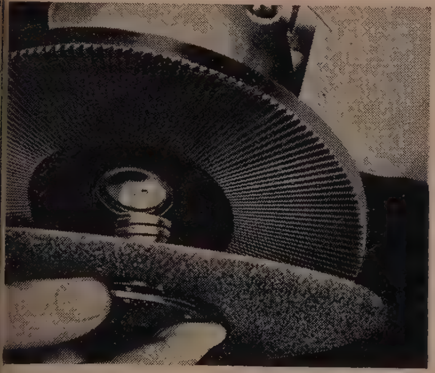
EW IDEA—Electric Hacksaw! as 2 speeds for cutting all metals from tainless and cast iron to mild steel, on-ferrous metals! (Model 701).



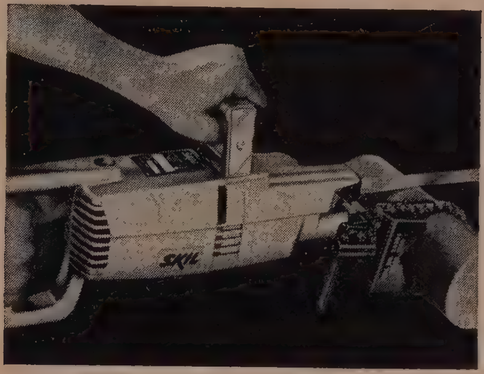
NEW IDEA—2-Speed Jig Saw! World's fastest—high speed for cutting wood, plastic, composition; low speed for metals (Model 160).



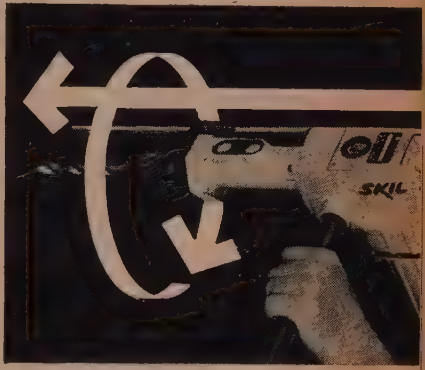
NEW IDEA—Skilsaw Worm Dri Saw Under $100. Has unequal cutting power; safety clutch. Cuts woo metal, stone. (Model 65).



EW IDEA—Treaded Disc Sander ad. Prevents disc slippage. Quick hange nut locks on steel pins—no ogged threads! (all Skil Disc Sanders)

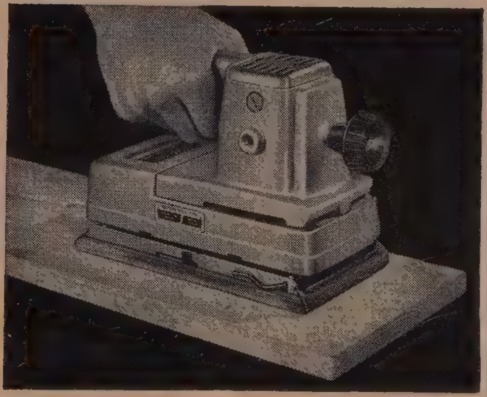


NEW IDEA—Recipro Saw With Built-In Vise. Makes cutting of pipe and bar stock easy, fast and accurate (Model 702).



NEW IDEA—3-Way Hammer. Ham mers, drills, does both simultaneous for fastest masonry drilling at lowe cost per hole (Model 726).

EW IDEA—Air Impact Wrenches ith "Balanced Blow." Deliver more ower than costlier makes without jar- ng "kickback." Many models.



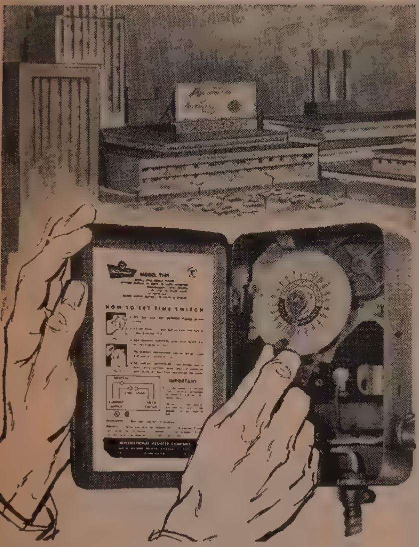
NEW IDEA—2-Way Sander. Orbital action for fast sanding . . . straight line action for finest finishing! Big 4½" x 9" pad. (Model 692).

NEW IDEA—Only All Purpose Sa Under $50. Cuts metal, wood up to inches thick. Cuts into corners, wal Makes scroll cuts too (Model 577).

Ask your Skil distributor for demonstrations. Look under "Tools-Electric" in the Yellow Pages. Or write for 68-page catalog: kil Corporation, 5033 Elston Avenue, Chicago 30, Illinois, Dept.130-K

SKIL
POWER TOOLS

WHEN PERFORMANCE REALLY COUNTS!
control it
"Intermatically"



Electrical contractors know and rely on rugged, dependable, T-Rated Intermatic switches. Built to perform continually under the most extreme conditions, Intermatic provides the reliability and accuracy necessary to meet the toughest, most demanding requirements—and you can depend on them. Fast, easy installation, fewer customer callbacks save you time and money. Engineered and built to give you more for your money, Intermatic switches build your reputation with customer satisfaction. Reliable quality—that's Intermatic!

special Intermatic® features!

SNAP-OUT MECHANISM, fast and easy to mount ■ 31 CUBIC INCHES of wiring space in the case ■ HEAVY-DUTY ALLOY-T CONTACTS (40 amps—4375 watts tungsten rated) ■ HI POWER SWITCHING MECHANISM and U-BEAM SWITCH BLADES for fast, clean, make and break ■ E-Z SEE DIAL for rapid settings.

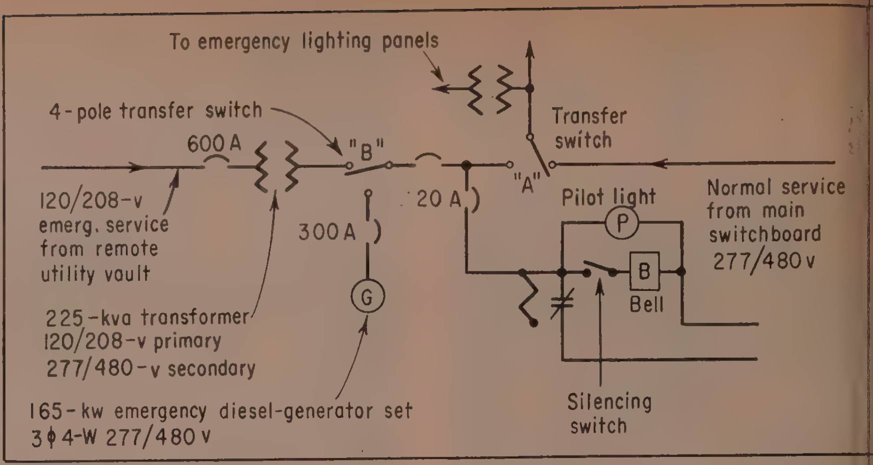
OVER 100 MODELS TO CHOOSE FROM!
- 125 to 250 Volts
- 10 seconds to 23 hour timings
- 1 to 96 operations per day
- Up to 55 amps
- Standard or "Skipper" models
- Astronomic Dial Switches
- UL-CSA approved

Meet Intermatic—get the complete story by mailing the coupon!

INTERNATIONAL REGISTER COMPANY
4710 W. Montrose Ave., Chicago 41, Illinois

☐ New . . . Special catalog for Apartment House Lighting
☐ Complete catalog of all products. Bulletin 112-B

NAME________________________________
COMPANY_____________________________
ADDRESS_____________________________
CITY_____________ZONE______STATE______
MY DISTRIBUTOR IS______________________

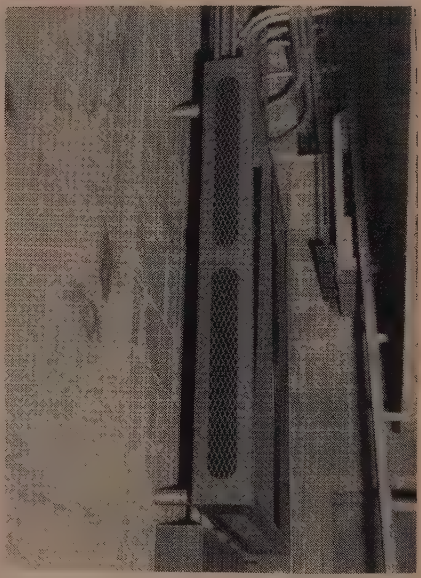

To emergency lighting panels
4-pole transfer switch
600 A
"B"
20 A
"A"
Transfer switch
Normal service from main switchboard 277/480 v
120/208-v emerg. service from remote utility vault
300 A
Pilot light
P
B
Bell
G
225-kva transformer 120/208-v primary 277/480-v secondary
165-kw emergency diesel-generator set 3ϕ 4-W 277/480 v
Silencing switch

EMERGENCY lighting circuits are normally served from main 277/480-volt switchboard although, should this power source be interrupted, transfer switch "A" would shift emergency loads to alternate 120/208-volt utility vault, the desired 277/480-volt power then being obtained through an intermediate step-up transformer located as shown. Should this second utility power source likewise be interrupted, transfer switch "B" automatically would start the diesel generator and would switch critical emergency loads to this third supply medium.

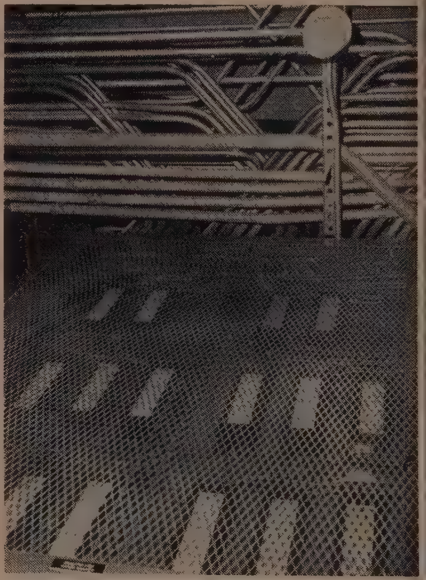
Should this normal power source be interrupted, emergency loads would be transferred automatically to a second, remote utility vault due to the closing of switch "A." However, since this second power source is 120/208 volts, it was necessary to provide an intermediate step-up transformer to attain the desired 277/480 volts.

Should this second utility source also fail, transfer switch "B" would be automatically activated so that a 165-kw diesel generator set would be started and connected to the distribution system to serve critical emergency loads, such as the lighting above the escalators.

The system, designed by John Graham of Seattle, Wash., was installed by electrical contractor W. R. Grasle of Portland.



ENCLOSURE formed basically of sheet steel is vertically partitioned to segregate normal-service from emergency-circuit ballasts related to nearby bank of 3-lamp fluorescent luminaires recessed above escalators. Ventilation is promoted by expanded-metal panels on front, sides, top and bottom, also by air gap behind it. Panel is held out from walls by sections of conduit, cut to desired lengths and placed around anchor bolts. Air gap plus use of rubber grommets also minimizes possibility of vibration transfer to walls or structural work of building.

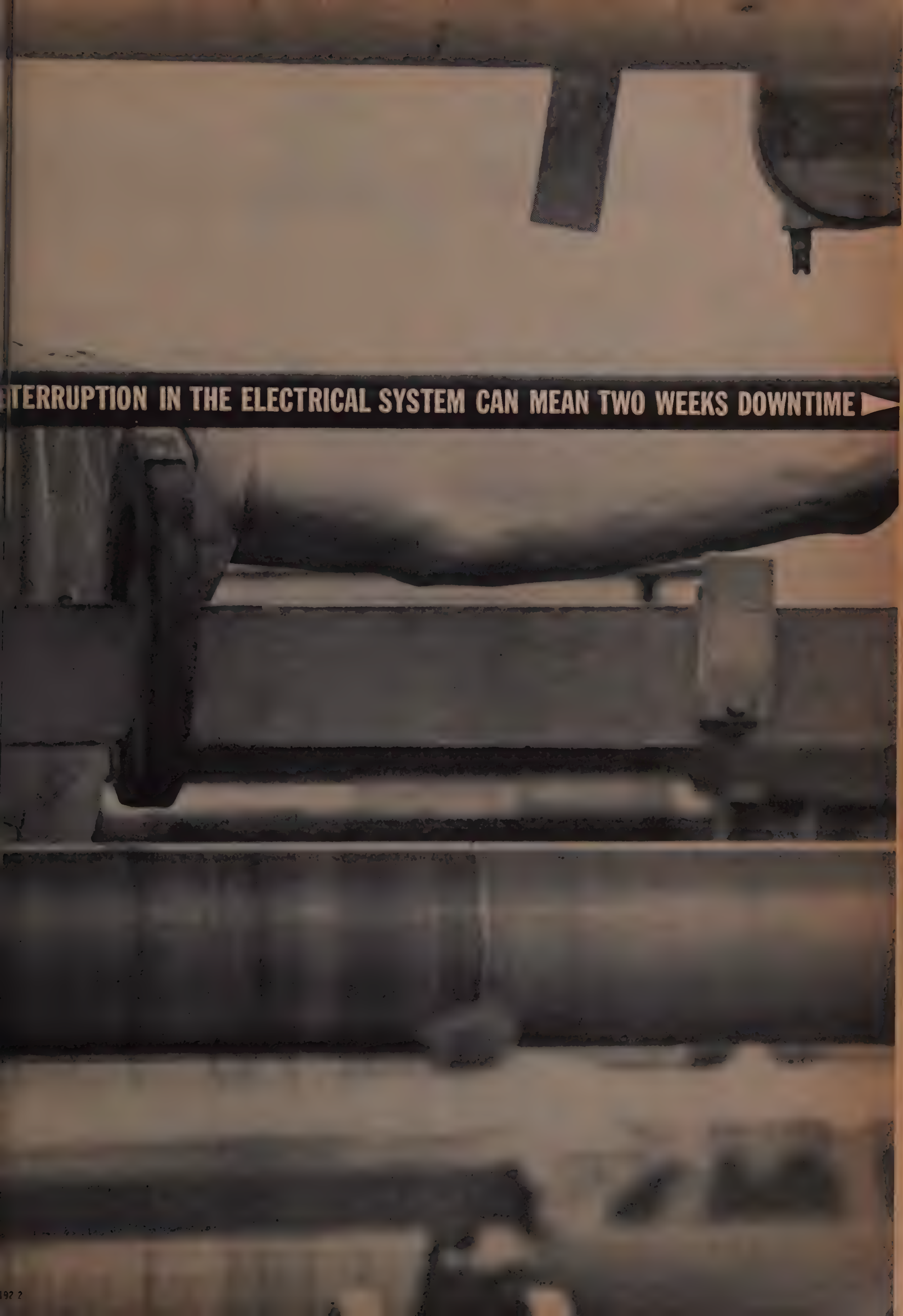


LOOKING UPWARDS through front removable perforated metal panel indicates placement of 16 ballasts, half on either side of central vertical partition. Each half is related to either normal or emergency circuitry. Connections between ballasts and their related 3-lamp fixtures are via 5-wire groups of No. 12 AVA wire contained in ¾-in. thinwall conduit seen as maze above enclosure. The emergency portion of the circuitry is shown in the diagram at the top of the page. Three sources of power assure continuity of critical loads.

MEET A TOUGH NUT . . . Just a gimmic to catch your eye? Hardly, it's symbolic because hickory nuts are tough. So are new "Sisal" impregnated NON METALLIC new work boxes by UNION. Now twice as strong, and don't forget the advantages you already know about such as lower initial cost—less installation time—no box grounding—no clamps—exclusive plaster seal—handy knock-outs. So if you've been drooling over the savings Union offers but have hesitated in favor of the old fashioned way—forget it! You deserve as much profit as your competitor. Complete line—boxes and covers, "Weatherbest" lighting fixtures, pigtail and pin type sockets, insulating, grounding and male bushings. UL approved. Contact your distributor now.

UNION INSULATING CO.
PARKERSBURG, WEST VIRGINIA

IN THIS FLEXIBLE PACKAGING PLANT, A TWO-HOUR
94192-1


TERRUPTION IN THE ELECTRICAL SYSTEM CAN MEAN TWO WEEKS DOWNTIME

SO CROWN-ZELLERBACH MADE SURE ELECTRICAL COMPONENTS WERE WESTINGHO

In St. Louis, Mo., C
Zellerbach Corporatio
cently constructed a
220,000-sq. ft. plan
their Western Waxide
sion, producers of fle
packaging material
cluding wax paper l
and wrappers. In a mo
time, hundreds of t
sands of pounds of l
wax is processed th
the plant. If a power fa
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It is in requirement
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sales follow-through l
a coordinated constru
schedule. All impo
reasons why, *You ca
sure . . . if it's Westingh*

CREDITS: *Owner:* Crown-
bach Corporation, San Fra
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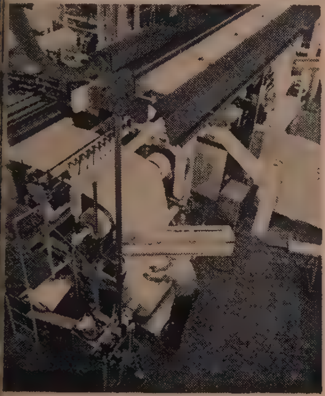
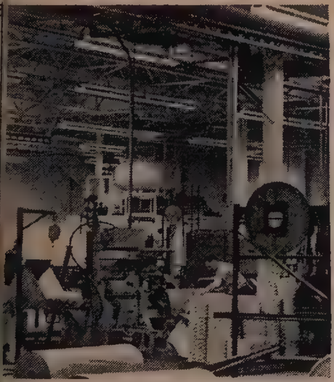
bert C. Martin and Associat
Angeles, Calif. *Electrical C
tor:* John Ledbetter Electr
St. Louis, Mo. *Westinghou
tributor:* WESCO, St. Loui

J-94192-3

executive offices like this or general offices, Ⓦ Mainliner minaires add distinctive styling nd high lighting levels.



Ceiling view shows intensified ilumination cast by Ⓦ Heavy-duty ndustrial luminaire on one of the etterpress printing machines.



Plant view shows consistent evenness of Ⓦ Heavy-duty Industrial lighting. A more than adequate 32-ft. candles is averaged by these 2WSOS two-lamp luminaires.

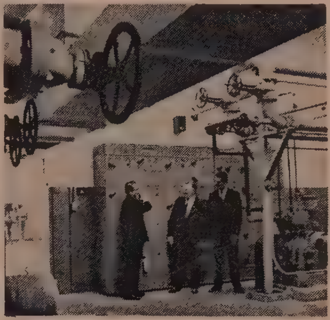
Discussing a Ⓦ combination Motor Control Center and Switchboard arrangement are S. N. Kraines, Waxide's Senior Indust. Engineer, Emil Zolezzi and Vince Kelly. New design, shallow depth switchboard matches control center, contains molded case circuit breakers feeding power circuits.

Discussing a Ⓦ Life-Line Starter located at a laminator waxing machine are J. R. Miller, Ⓦ Construction, and John Day, Project Engineer, A. C. Martin & Assoc.

Centralized control at tank mixer provided by Ⓦ Class 11-350 Motor Control Center. Stacked starter units can be interchanged, are engineered to reduce hazards and are easy to maintain and install. Left to right on platform are: Hal Forister, Ⓦ, Emil Zolezzi, Tom Fogarty, V. P., Ledbetter Electric, and S. N. Kraines.

Emil Zolezzi, WESCO, and Vince Kelly, Ledbetter Electric's Superintendent, discuss Ⓦ type NLAB Panelboard. A compact, lightweight 75-Kva Dry-type DT-3 Transformer was easily mounted overhead, providing 120/208 V.

Hal Forister, Ⓦ, explains function of 15 Kv main 150 DH250 air-circuit breaker in this metal clad switchgear line-up to Messrs. Kraines, Fogarty and Zolezzi. Plant's distribution system is designed so that in case of fault, one power center feeder can be isolated while others still operate.



Discussing the ease of operation of a starter unit are Messrs. Forister, Fogarty and Kraines. This motor control center uses combination Life-Line Starters for fast, positive protection of all mechanical equipment room motors.

Paul Olschner, WELCO Dist. Const. Mgr., St. Louis, shown at a 150-Kva outdoor Inerteen® power center. This completely self-contained unit, with non-flammable coolant, provides circuit protection and supplies power to an emergency fire pump for plant protection.

Messrs. Olschner and Miller view Type DB Circuit Breakers used in the LV switchgear end of a 750-Kva Power Center. Type DB breakers are well applied in industrial plants where power switching and protection is required. Draw-out feature allows easy maintenance.

Westinghouse

-94192-4

now available!

SYLVANIA FIXTURES with HOLOPHANE CONTROLENS®

To offer you a wider selection than ever in the choice of quality shielding materials, Sylvania now offers Holophane Controlens No. 6150 and No. 6250 as cataloged items with the fixtures shown on this page.

These Holophane lenses, made of acrylic plastic, feature precise prismatic control of light providing high illumination with a minimum of brightness and glare.

Look to Sylvania to meet your lighting requirements. You get a broad selection of quality fluorescent lighting fixtures plus a wide, wide choice of shielding media.

The following Series of Sylvania Fluorescent Lighting Fixtures can now be obtained with Holophane Controlens® No. 6150 — (1′ x 4′ Panel) and No. 6250 —(2′ x 4′ Panel).

Sylvania's Mohawk Series Shallow, attractive surface-mounted units with clean, rectangular lines. One and two foot widths . . . four and eight foot lengths. High efficiency. Perfect for low ceilings.

Sylvania's Recessed Troffers

Extremely versatile. Truly shallow. Suitable for most nationally-known ceiling systems. Wide choice of widths, lengths, lampages. Simple, fast installation. Concealed hinges and latches.

Sylvania's Sylva-flo Troffers

Combines lighting and air-handling in one efficient unit. Offers outstanding lighting and mechanical qualities of Sylvania Troffers integrated with Multi-Vent system of low-velocity air diffusion.

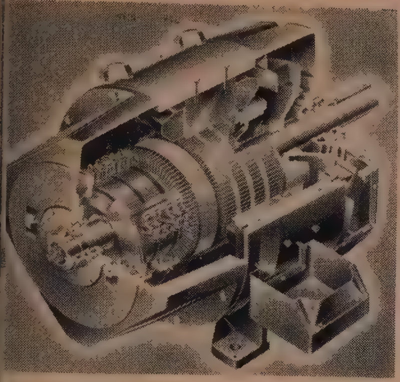
®Registered—Holophane Co., Inc.

Multi-Vent is a registered trademark of The Pyle-National Co.

SYLVANIA

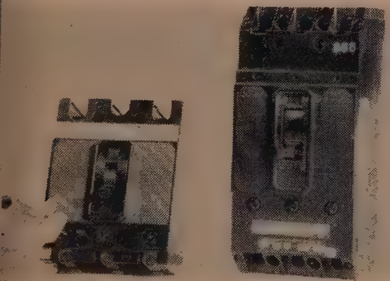
SUBSIDIARY OF
GENERAL TELEPHONE & ELECTRONICS

SYLVANIA LIGHTING PRODUCTS A Division of SYLVANIA ELECTRIC PRODUCTS INC. One 48th Street, Wheeling, West Virgi



C Motors (1)

Announcement has been made of
ew lines of big "Kinematic" dc
achines and metal-rolling motors.
ine comprises motors from 250 to
250 hp and generators rated 200
) 800 kw. Frame diameters run
rom 38½ to 62½ in. They will be
sed as prime movers and dc power
ipply for heavy industrial adjusta-
le speed drives. The new machines
ill bear the prefix CD. A second
ne of machines incorporating
haracteristics especially required
or steel and non-ferrous metals
pplications will be prefixed MCD.
mong the predesigned kits avail-
ble for mounting on standard ma-
nines are various types of covers,
lowers, and other ventilating ar-
angements, brakes, belted or
irect drive tachometers, speed
mit switches and belted exciters.
General Electric Co., Schenectady
N.Y.



ircuit Breaker (2)

Compact 100-amp EF-frame ETI
olded-case circuit breakers are
ow available. Designed for use in
otor control centers, combination
arters or individual enclosures,
F-frame ETI breakers require
)% less space. The ETI circuit
eakers feature front-adjustable
stantaneous trip. They serve as
eavy-duty disconnects and short
rcuit protection for motor branch
rcuits. When used in combina-
on starters, the breakers are coordinated with motor protective relays for complete protection. The relays guard against motor overloads; breaker guards against short circuits and ground faults. Continuous ratings from 3 to 100 amps are available. Interrupting rating is 15,000 amps, asymmetrical, at 600 volts ac. Instantaneous trip is adjustable within the minimum-maximum range of each breaker.

I-T-E Circuit Breaker Co., 1900 *Hamilton St., Philadelphia* 30, *Pa.*

Modular Ceiling (3)

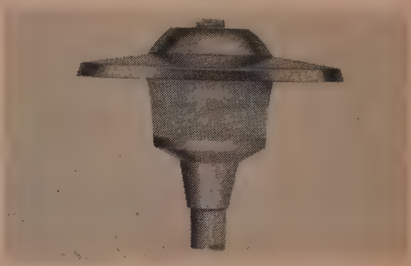
A new prefabricated luminescent bathroom ceiling containing fluorescent lights, incandescent night light, a concealed fan and one or more infrared heating elements has been announced. Ceiling is designated "The Comfortaire." Modular construction permits installation in any bathroom shape or size. Panels are white plastic eggcrate design. Slender supports are of aluminum in white finish. Entire ceiling comes in one package, partly pre-assembled and ready-to-install.

Emerson-Pryne Co., 8100 *Florissant, St. Louis* 36, *Mo.*

Cable Cutter (4)

New EnerPac cable cutting unit equipped with a calibrated cable-size indicator has been introduced. Designed to facilitate stripping, the calibration attachment indicates proper depth of cut to remove the insulation from specific size of cable being handled. New cutting unit is designed to handle up to 1,000,000 c.m. cable or high voltage cable up to 2 in. outside diameter. Indicator attachment has eight calibrations in all, from 250,000 c.m. to 1,000,000 c.m. Cutter is available with or without hydraulic unit and fits any make of knockout punch set.

Blackhawk Industrial Products Co., Dept. CC, Butler, Wis.



Outdoor Lighting (5)

A new post top luminaire, called Stylette, furnishes illumination for parks, malls, driveways, patios, and similar areas. Standard household lamps rated up to 200 watts can be used in Stylette units when prism refractors are of acrylic plastic. With heat-resistant borosilicate glass refractors, the luminaire will accommodate lamps up to 405 watts. Units are constructed of aluminum.

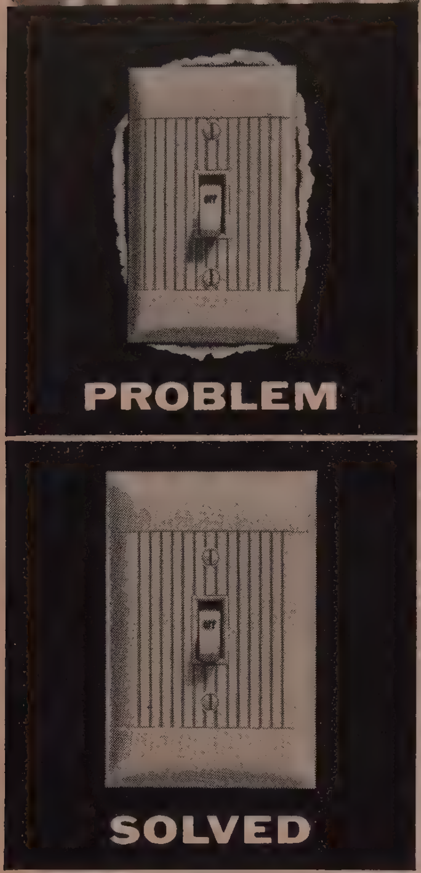
Line Material Industries, McGraw-Edison Co., Milwaukee 1, *Wis.*

Telephone (6)

An explosion-proof and dust-ignition-proof telephone has been developed and is UL-listed specifically for Class I, Div. 2 hazardous areas. The new ET Series operate on a common battery system and are available in both dial (ETWA-227) and manual (ETWM-227) models. They are designed for both wall and console mounting. Each model has an explosion-proof handset with a 5-ft extended length of coiled cord attached to a flame-tight cover assembly by a factory-sealed connector. The ringer is available in either a general-purpose sheet metal housing or a weatherproof enclosure. Each ringer housing has a screened bottom for a loud bell signal. Body of enclosure is designed for a ¾-in. threaded conduit to enter at either the bottom or at the center of the back.

Crouse-Hinds Co., Syracuse, N. Y.

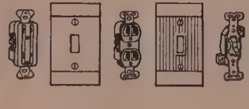
SIERRA

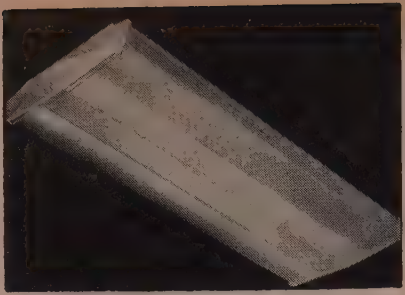


JUMBO PLATES®

Jumbo-Plates are 30% larger...real handy when you're faced with oversized holes or chipped plaster. Jumbo-Plates are available in all popular openings, and match Sierra's "D"-line plastic, Stainless Steel, and Brass Plates. New 302 Stainless for extra corrosion resistance. Keep a variety on hand—it pays.

SIERRA
ELECTRIC
CORPORATION
15100 SOUTH FIGUEROA STREET
BOX 85, GARDENA, CALIFORNIA
Write for more information and catalog





Luminaire (7)

New Criterion IV luminaire provides comfortable lighting and higher footcandle levels for school, office and store lighting. Unit is designed for either surface or pendant mounting, individually or in continuous rows. Four-lamp luminaires are available in 2- and 4-ft lengths. Eight-lamp units are 8 ft in length. All Criterion luminaires are UL listed with CBM ballasts for operation in 110/120-volt, 60-cycle circuits. Bulletin is available.

Lighting Products Inc., Highland Park, Ill.

Electric Power Tool (8)

A new portable electric power tool, called electronic Variable Speed Porta-Band, with variable speed drive has been introduced. Key to the variable speed control is a ½ lb electronic package about the size of a cigarette pack. The encapsulated epoxy package contains a silicon-controlled rectifier, diode and all other electronic components. The "full wave" electronic speed control device gives power on every cycle. The Porta-Band operates at an infinite number of cutting speeds between 80 and 250 surface ft per minute. The electronic Porta-Band is designed for extra-heavy-duty cutting of steel, brass, aluminum, copper, plastic and similar materials. The 4.5/6.5 amp, universal motor is rated 115 volts, 25-60 cycles.

Porter-Cable Div., Rockwell Mfg. Co., 400 N. Lexington Ave., Pittsburgh 8, Pa.

Trencher (9)

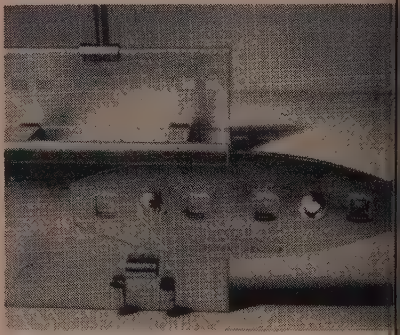
A new pivoted front axle that may be turned hydraulically for correctional steering when trenching or when angle dozing is one of the features on the new Model KS Ditch Witch trencher. In addition, a 4-speed digging chain is provided. This 4-wheel drive machine is capable of digging depths to 6 ft and widths up to 16 in. The hydraulic drive in digging speed provides o eration at up to 12 FPM standar and when operating conditions pe mit, a high speed sprocket is ava able to increase this to 17 FP The backfill blade is standard equi ment on the Model K3. It raises a lowers hydraulically and may used straight or angled 30° to eith side.

Charles Machine Works, In West Ditch Witch Rd., Perry, Ok

Concrete Saw (1

A new 30-hp concrete saw, d signed for medium to heavy produ tion sawing, has been announce Model C-302 is powered by specially designed 30-hp Wiscons engine featuring stellite faced e haust valves and inserts, valve r tators and oil bath air cleaner a precleaner. It also features du balance design that allows one ma to line up in seconds for eith longitudinal or transverse sawin The C-302 is equipped with b bearing positive screw feed. Bla saver switch automatically shuts the engine when water pressu drops below proper level.

Clipper Mfg. Co., Suite 149, P. Box 453, Kansas City 8, Mo.



Cable Tray System (1

A complete tray system for el trical power and control distrib tion has been introduced. Kurl ladder type tray is available in g vanized steel or aluminum. Straig lengths of tray, vertical rise horizontal elbows, tees, wy crosses and reducers are offered various side rail depths, in widt of 6, 9, 12, 18, 24, 30 and 36 in., a with rung spacings of 3, 6, 9, and 18 in. on centers. A new se aligning splice plate requires th parts to make a straight run asse bly and five parts for curve spl connections. Dropouts can be ma without additional cutouts.

Kurlok Div., Unistrut Produ Co., 1015 W. Washington Bl Chicago, Ill.

QUALITY

How far will you let your suppliers stretch this word?

Quality.

An easy word to drop into sales talk. A simple word to include in advertising and promotion material.

But a tough word to live up to.

How often have you seen it used? Top quality ...high quality...unequalled quality...exceptional quality! Too often it is used in this very way to describe products which you know from your personal experience to be sub-standard. Indeed, the word "quality" has been stretched so far—and applied so loosely—throughout the electrical industry that its original meaning is often lost.

Electrical fitting made of powder puff metals that are bound to crack under strain are labelled "quality." This is true of other fittings which are just so many pieces of iron made without adequate quality control. But none of these deficiencies prevent some manufacturers from stretching a point to add the luster of the word "quality" to their products.

Who pays for this "word stretching?" For one, the electrical contractor who has to discard sub-standard fittings and add expensive labor costs in the repair of the installation. Another? The industrial electrician who faces downtime when fittings strip, connections loosen, wires ground out—causing machinery breakdown. And of course, the wholesaler who jeopardizes his reputation with fittings that cost his customers time and money and cost him vital goodwill.

At Gedney, quality is more than a word. It is the very foundation upon which our business stands.

Our customers are certain that when they pay for a box of 100 fittings they will get 100 fittings that deliver perfect performance. They know that threads will be clean, precision-cut...that plating will be to thicknesses far beyond minimum requirements. They know that Gedney fittings are made of malleable iron...the toughest metal known for electrical fittings...that Gedney entrance caps, for example, are hot dip galvanized inside and out... that Gedney locknuts are *really* locknuts, not just pieces of thin pressed metal...that Gedney Liquid Tight Connectors hold beyond the breaking point of the conduit. That's the way it is with Gedney ...right on through our entire product line.

The confidence, loyalty and respect of the professionals who know electrical fittings best, are things we are most proud of at Gedney. Our business is built on the knowledge that there are no short cuts to quality. Our customers come back year after year, job after job because they have learned that Gedney fittings always give them the dependability that adds up to the lowest final installed cost. That's what we mean by "quality" at Gedney.

Specify "Quality" the next time you buy fittings... specify Gedney

GEDNEY

GEDNEY ELECTRIC COMPANY, INC.

General Offices: 1270 Sixth Avenue, Radio City, New York 20, N. Y. Foundry, Factory & Shipping Point: Terryville, Conn.

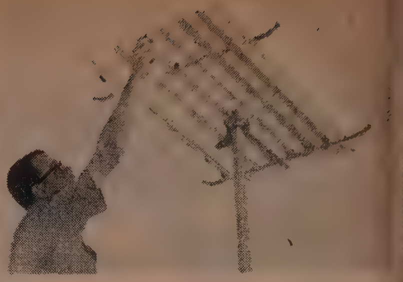
THERE ARE 11,482 OPPORTUNITIES
TO SAVE MONEY
IN LIGHTING THIS STREET

THIS UNION
PIN-TYPE SOCKET
MEETS THEM ALL!

L. C. Williams of Houston, Texas, the nation's largest manufacturer of Christmas Decorative Lighting, uses UNION pin-type sockets exclusively . . . The reasons are simple—over the years they have been dependable and they have lowered costs by reducing installation time.

UNION offers a complete line; candelabra base, intermediate base, medium base and streamers, all immediately available from factory and local stocks.

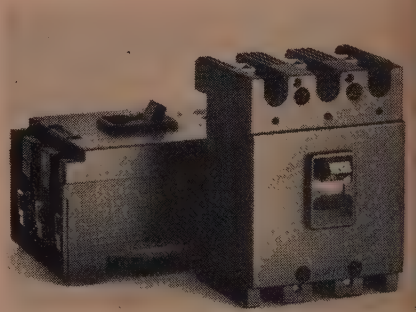
UNION INSULATING COMPANY
PARKERSBURG, WEST VIRGINIA



Hoist **(12)**

Electrical contractors can now lift 450 lbs of conduits, standard or recessed lighting fixtures, display signs and other material at the touch of a button. The new air lift hoist weighs 42 lbs and is easily carried in a car trunk. Remote control unit allows operator to guide heavy material to exact position for permanent installation. Operator loads at convenient 4-ft level and selects any height up to 18 ft. An adjustable height-limiter can be set for multiple lifts to a specific level.

Genie Manufacuring Corp., Kent, Wash.



Magnetic Breakers **(13**

New 480-volt, 100-amp (max.) hydraulic-magnetic circuit breake is furnished with a choice o three factory-set, instantaneous trip ranges. Designated Series EH breaker permits a user to choose a trip range that is high enough t allow starting inrushes as high a 2000% without tripping, yet lov enough to interrupt short circuit instantaneously. The three tri ranges are 700-1000%, 1000-1400% and 1400-2000% of rated load. Series EH breaker is designed fo general panelboard and switchboar use and especially for motor starting and other high inrush applications. It is available in 2- and 3-pol construction for 480-volt ac, 6 cycle, polyphase service and for d use on special order. There ar eleven standard current rating from 10 to 100 amps. Bulleti T-3440 is available.

Heinemann Electric Co., 23 Magnetic Dr., Trenton 2, N. J.

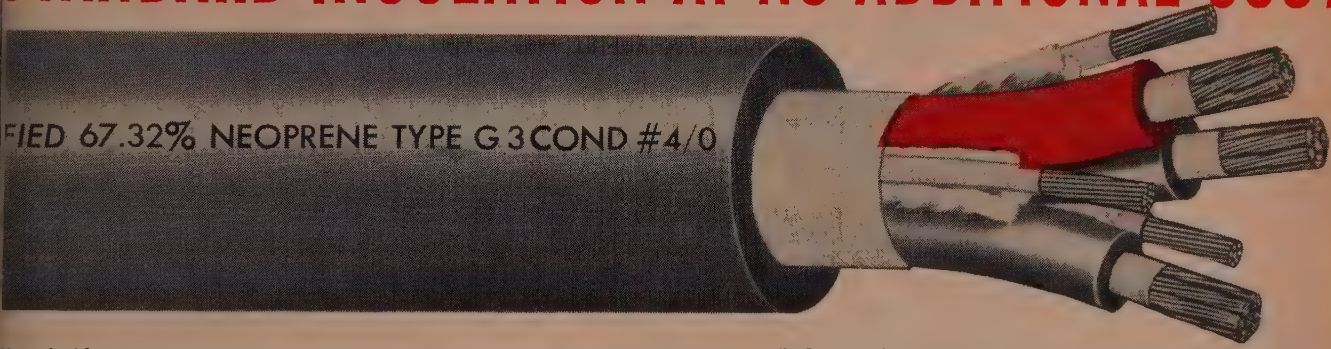
SAVE
p to
20% with

BRONCO
Certified 66
NEOPRENE

FIRST 600 VOLT W&G PORTABLE CABLES WITH

XL 85°C BUTYL

STANDARD INSULATION AT NO ADDITIONAL COST



Now, inside as well as out, Bronco 66 Certified types W and G cables are given all the protection modern science and technology can provide for a portable 600 volt cable. To the 67.32% neoprene outer protecting jacket—still the highest content in the industry—is added the inner protection of Bronco XL Butyl insulation. XL Butyl is markedly superior to ordinary rubber insulation in its resistance to aging, moisture, ozone, corona cutting, and especially to heat. It has much better electrical properties. We believe Bronco XL Butyl is in all respects the finest insulating material available for use in portable cables.

Butyl-insulated Bronco 66 is not a "special"; not an alternate vaguely "available." You don't have to ask for Butyl, just ask for Bronco 66. Virtually all of the vast stock now in the Bronco nationwide network of Servicenters is insulated with Butyl. What's more, the addition of XL Butyl to Bronco 66 does not increase its cost to you by one cent.

RATED FOR 85°C COPPER CONDUCTOR TEMPERATURE Probably the biggest advantage to the user of XL Butyl is the 85°C ampacity rating of Bronco 66 W and G cables. This means that, compared to a 75°C-rated rubber-insulated cable, a greater current load can now be carried by a conductor of given size. Conversely, with a conventional load, a tremendous safety margin is built in to protect the cable from temporary overloads.

PURCHASER CAN SAVE UP TO 20% When you inspect the 85°C ampacity tables, you will see that an awg size 2, three-conductor XL Butyl-insulated Bronco 66 cable will carry the same load as a size 1 with HR insulation. The savings are about twenty percent. In smaller sizes also, a cable one or two awg sizes smaller occasionally may be used.

XL Butyl insulation gives you one more compelling reason for always insisting on the best—Bronco 66 Certified.

WESTERN INSULATED WIRE COMPANY
Los Angeles 58, California

Please rush sample, new ampacity table, and complete information on your new XL Butyl-insulated Bronco 66 Certified 600-volt electrical power cables.

NAME____________________

POSITION____________________

COMPANY____________________

ADDRESS____________________

CITY____________ZONE____STATE______

SOLD NATIONALLY THROUGH ELECTRICAL WHOLESALE DISTRIBUTORS

HEAVY-DUTY HAMMER-DRILL KIT

Specially built to drive anchor holes ¾" or under in masonry, the new Hammer-Drill is light, powerful and fast. Job-tested in the field, this 1300 RPM tool cuts drill-and-set cost time . . . puts ½" holes 3" into 1-2-4 concrete in 19 seconds. And it's low-cost, about half the price of larger hammers.

The Heavy-Duty Hammer-Drill is versatile, too! An exclusive B&D mechanism shifts from percussion drilling to direct drilling for other jobs—twist drilling, augering, hole sawing, etc. The complete Kit includes a depth gage, ½" carbide tipped bit, side handle and steel kit box (and there's a full line of carbide tipped bits as accessories). Also available as a separate unit, the Heavy-Duty Hammer-Drill fills a real need. You'll find it at leading distributors everywhere. For sales or service look in the Yellow Pages of your Telephone Book under TOOLS ELECTRIC

BLACK & DECKER SERVICE keeps these hammers working! It's done through a network of Factory Service Branches throughout the U.S. and Canada, where tool repairs, replacements and overhauls are handled quickly and correctly by factory-trained men using genuine factory parts. Toughest repair jobs are handled fast . . . and covered with a guarantee. **Also check on our new carbide bit sharpening service.**

B·D **Black & Decke**

MAKER OF THE WORLD'S FIRST CORDLESS POWER T

MP **Master Power**
POWER TOOLS

D DEWA
POWER TO

HEAVY-DUTY ROTARY HAMMER

It outperforms any tool in its class! If your job is drilling holes, Black & Decker's new Rotary Hammer with percussion carbide-tipped bits will do it for the lowest possible cost per hole. That's in addition to all the usual jobs you put a Hammer to—chiseling, channeling, demolition and others. The secret is a combination of rotary action and hammering action in a lightweight, rugged tool . . . PLUS an exclusive slip clutch action that prevents locking-up, protecting the operator if hammer tool jams in material.

Heavy-duty construction and advanced Black & Decker engineering give the kind of long life you may have given up hoping for in hammering tools. For any jobs from ¼" to 1¼" capacity, see and try the new Black & Decker Heavy-Duty Rotary Hammer. At leading distributors everywhere.

NEW FROM LACK & DECKER!

The Black & Decker Mfg. Co., Dept. 1211
Towson 4, Md. (In Canada: Brockville, Ont.)

Please arrange for a demonstration of the
☐ Heavy-Duty Hammer-Drill ☐ Heavy-Duty Rotary Hammer

Please send me more information about ____________

Name____________ Title____________

Company____________

Address____________

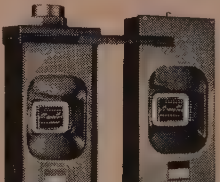
City____________ Zone____________ State____________

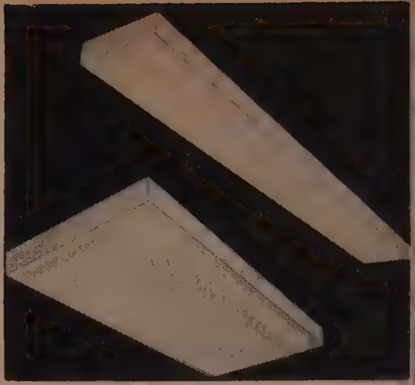
LOOK! a 200-amp breaker no bigger than this

Heinemann's SE-33 circuit breaker (shown actual size) needs only half the panelboard space of comparably-rated breakers. In an enclosure (indoor and outdoor types available), it's considerably smaller than a fused switch or pullout of equal rating. A two-pole breaker, the SE-33 is magnetically actuated—never has to be de-rated for high ambient temperatures. It accepts copper or aluminum conductors in sizes from #6 to #250, CM, CU/AL, has pressure-type solderless connectors. Available in standard ratings of 125, 150, 175 and 200 amps, 120/240V AC. Priced advantageously. Bulletin 1003 will give you detailed information.

HEINEMANN ELECTRIC COMPANY ◈ 2606 BRUNSWICK PIKE, TRENTON 2, N. J.

2435

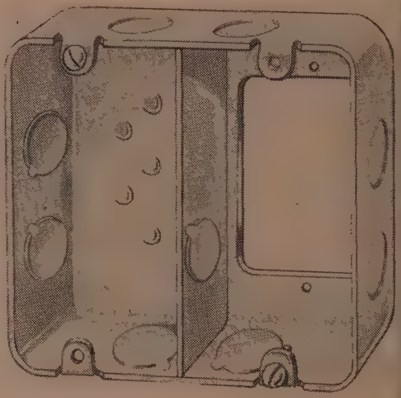




Luminaire (14

A new series of modular, on-surface fluorescent luminaires for us in offices, stores, schools, hospital and other commercial and industrial lighting applications. Th Panelmetrics are available in si sizes—1 by 4 ft, 1 by 8 ft, 2 by 8 ft, 2 by 4 ft, 2 by 2 ft, and 4 by 4 ft. Choice of shielding for thes luminaires consists of rigid-arc styrene; clear plastic lens; stee louver; plastic louver; rigid-arc acrylic; and Corning No. 70 lens Panelmetrics are available with solid metal sides or molded plasti luminous side panels. The 4- and 8-ft luminaires are designed fo rapid start fluorescent lamps and the 2-ft units for trigger start.

Wakefield Lighting Div., Wakefield Corp., Vermilion, Ohio



Outlet Box (15

A 4-11/16 in. square room t room outlet box designed for 2-in partitions only, has been developed It provides an outlet opening o both sides of a thin wall partition With the welded barrier, in th center of the box, together with th 4-11/16-in. square off-center cover two complete outlet boxes ar formed, each with four sides and a solid back. On both sides, the openings are designed for mounting on wiring device each.

Arrow Conduit & Fittings Corp. 180-20 180*th St., Jamaica* 33, *N. Y*

Reed Relays (16)

A new line of reed relays for control circuits where dirty or corrosive atmospheres are present. These reed relays are assemblies of dry reed switches in convenient modular steel enclosures. Operating coil and switch terminals are brought out to a molded terminal block at top of relay and all internal parts are supported from this molding. They may be operated with a filtered dc source. Four sizes of relays are built using these switches. They all have the same height and length, and only vary in width and number of poles. Sizes include 3-, 6-, 9- and 12-pole combinations.

Allen-Bradley Co., 102-G West Greenfield Ave., Milwaukee 4, Wis.

Tool (17)

A new power "Nibbler" for cutting corrugated and sheet metal has been announced. It makes straight, curved, and pattern cuts, makes pocket (inside) cuts from any ½ in. dia starting hole. Actual cutting is done by a carbide punch. It weighs 5¼ lbs.

Skil Corp., 5033 Elston Ave., Chicago 30, Ill.

Control (18)

A new line voltage control, designated as the M-9, features snap-on covers available in a wide variety of textures and designs, as well as a full range of decorator colors. The M-9 "Wall Hugger" thermostat has slim design. It features a temperature range of 50° through 90°F; snap action switching; large bimetal sensing element; full-view dial. Two basic models are available: single pole and double pole. Rating of 22 amps at 125, 250, 277 volts ac. UL listed.

Mears Controls, Inc., 13725 S. W. Millikan Way, Beaverton, Ore.

Amp-trap clears the fault and limits the current to safe levels, no matter how high the short-circuit. Anticipates and prevents destruction. Withstands highest available short-circuit currents and limits the energy as required by circuit components. Far faster than ordinary fuses.

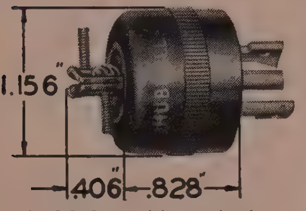
Form 600 Amp-trap is available in many types. It is for 600 volt AC or DC power circuits. Gives back-up protection for circuit breakers, motor starters, distribution equipment. It runs "cool" and prevents thermal and mechanical damage from high available short-circuits. There is an Amp-trap for every purpose.

Ask for information on the Amp-trap that will fit your particular requirement.

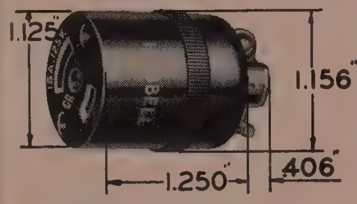
Amp-trap® ALWAYS *"Awake At The Switch"*

THE **CHASE-SHAWMUT** CO.
374 MERRIMAC STREET • NEWBURYPORT, MASSACHUSETTS
Subsidiary of I-T-E CIRCUIT BREAKER CO.

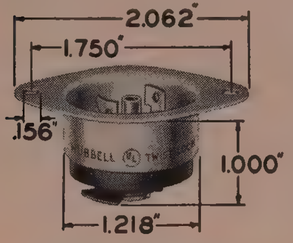
NEW
MIDGET
3-WIRE TWIST-LOCK® DEVICES
15a., 125v.
FOR GROUNDING APPLICATIONS



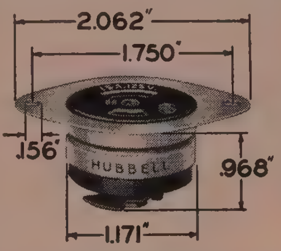
7594 Cap with cord grips
Cord dia. .281 to .421



7593 Connector Body with cord grips. Cord dia. .281 to .421



7595 Flanged Inlet



7596 Flanged Outlet

Midget Size
For panel boards, instruments, small appliances and other electrical equipment where wiring space is at a premium.

For Grounding Only
Designed specifically for 15a., 125v. grounding applications. All units feature insulated cord grips. An upset green hex grounding screw prevents easy removal or replacement.

Locks Securely
"Twist-Lock" devices lock securely, cannot pull apart accidentally or disconnect as a result of vibration.

Non Interchangeable
Grounding pin and sleeve design distinguishes these devices from regular 10 amp., ungrounded Midget "Twist-Lock" devices and makes the two types non-interchangeable.

Rugged
Heavy duty construction assures dependable performance and long trouble-free life. Units are listed by Underwriters' Laboratories, Inc.

IT PAYS TO HAVE HUBBELL GOOD CONNECTIONS

HARVEY
HUBBELL
INCORPORATED
Bridgeport 2 Connecticut
In Canada: Ajax, Ontario

®"Twist-Lock" is a registered trademark of Harvey Hubbell, Incorporated

Capacitor (19

A new 480-volt, 3-phase capacito has been announced. The 50-kva power capacitor is available in single unit. It is an outgrowth o FPE specially designed units fo the induction furnace field and i now being made available for gen eral industrial use. The capacito is fully tested and field proven i industrial heating and utility sec ondary distribution applications.

Federal Pacific Electric Co., 5 Paris St., Newark, N. J.

Ground Fittings (20

A new series of solid bronze allo ground fittings for bare groun wire, bare armored ground wir rigid conduit or EMT and rigi conduit, has been announced. Water pipe sizes are ½ in.-¾ in.-1 in and 1¼ in.-1½ in.-2 in. All hav pivot tops. Bulletin SB62-21 i available.

All-Steel Equipment Inc., Auror Ill.

Floodlight (21

New series of floodlights permi on-the-job focusing for more pr cise beam coverages in outdo areas, architectural, and sign ligh ing. A calibrated dial mechanis moves the quartz iodine lamp fo ward or back inside a double par bolic reflector to achieve a wid range of frequently required vert cal beam spreads, as well as asym metrical beams for oblique surfa illumination. Features include built-on bubble level, built-on rif sight, horizontal leveling devic built-in splice chamber, hing back relamping door, vertical ai ing quadrant, arm-gripping loc ing teeth, and a heat, shock and i pact-resistant "wrap-around" le shield. Line includes floodlights f 500- and 1500-watt quartz iodi lamps, with cast aluminum moun ing devices for pole-top, mid-pol wall, or crossarm use, singly or clusters. Bulletin QA is availab

Stonco Electric Products Co., 3 Monroe Ave., Kenilworth, N.J.

Garden Light (22)

A new type of luminaire for soft, low-level lighting of commercial, institutional, or estate areas has been announced. The garden light is contemporary in design, yet harmonizes with either modern or traditional architectural styles. Upper half of unit is dark green; lower half is translucent white. Diffusers, molded of Plexiglas, are available in 24- and 30-in. diameters. Both the 24- and 30-in. luminaires may be ordered for 60-watt 3-lamp incandescent service. The 30-in. model may also be ordered for a single 100-watt mercury lamp. Luminaire is equipped with either a built-in high-reactance transformer for 120-volt primaries or a built-in reactor-type ballast for 240-volt primaries. Luminaires slip 2-in. aluminum or steel poles that are available in 3-, 5- or 6-ft lengths.

Revere Electric Mfg. Co., Chicago 48 (Niles), Ill.

Bench Saw (23)

Operator designed and field tested new and improved safety features have been incorporated as standard equipment on their bench model abrasive saw. New heavily reinforced wheel guard and front spark shield totally encloses the cutoff wheel at all times for maximum safety. Additional safety features include enclosed belt guard, pushbutton electrical control system, and dual vise grip control action.

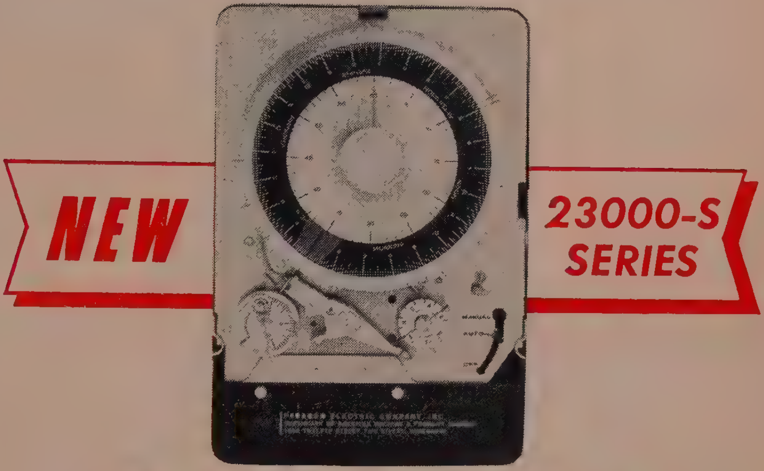
Collins Machinery Corp., Monterey Park, Calif.

Concrete Saw (24)

New 18-hp concrete saw, Model CS-500, features a positive hydraulic feed for blade raising and lowering. Hydraulic system is assisted by a spring-loaded mechanism for rapid removal of blade. Powered by an 18.2-hp air-cooled, 4-cycle Wisconsin engine, Model CS-500 is maneuverable due to: four-wheel suspension—solid rubber tires mounted on non-sway, ball bearing wheels; lightweight—500 lbs; compact size: height 42 in., over-all width, 32 in., over-all length, 66 in. Unit is available in both manually operated and self-propelled models. It is equipped with dual mounted 14-in. hinged blade guards for left or right side cutting.

Champion Mfg. Co., 3700 Forest Park Ave., St. Louis 8, Mo.

need a
PROGRAM
INSTRUMENT
for operating
audible Time Signals?



PARAGON
makes it!

This completely new 23000-S Series Program Instrument is precision built, extremely accurate, easy to set—designed and engineered by Paragon to meet the most exacting requirements of signal instruments.

Tap this ready-made market...

Schools • Factories
Churches • Office Buildings
Process Timing in Food, Chemical and Industrial Plants
Testing of Volunteer Fire Alarm Systems

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Paragon Commercial and Industrial Time Controls are sold to dealers, contractors and industrial end users ONLY through our Authorized Wholesale Distributors

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AMF
PARAGON ELECTRIC CO., INC.
Subsidiary of American Machine & Foundry Company
1614 TWELFTH STREET • TWO RIVERS, WISCONSIN

Time is money... control it with Paragon

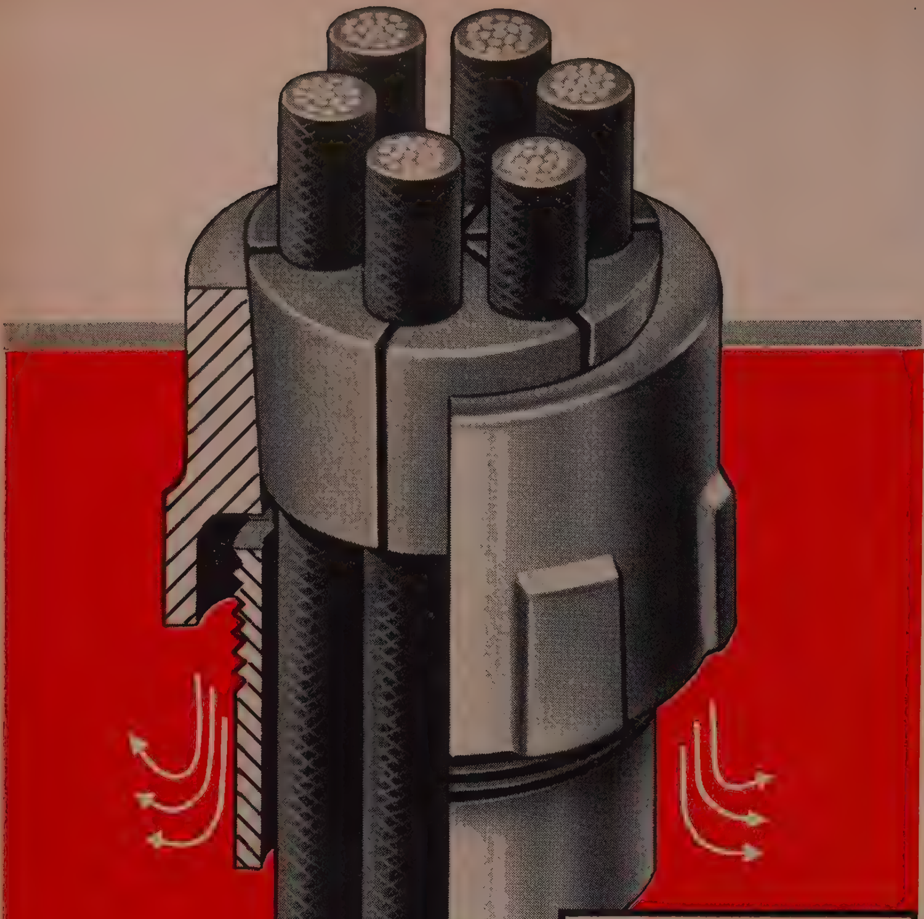
Look
at it
this
way
!

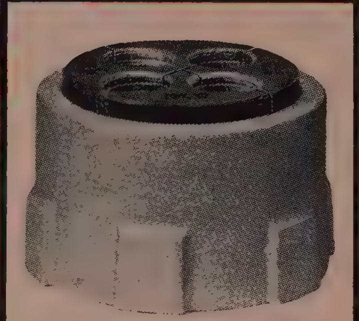
No other type of conduit is so easy to bend, costs so little to install

With a hickey or an EMT bender (one size larger), Alcoa *aluminum* electrical rigid conduit is easier to bend. And this is only one of the ways aluminum conduit saves installation time and money. It's also much easier to cut. Easier to thread, using a sharp regular die. Easier to carry and position, because of its lighter weight. Its smooth, specially-lubricated interior makes cable pulling easier. □ Alcoa aluminum rigid conduit makes a better installation as well as a more economical one. It is naturally corrosion-resistant: needs no painting or other protection. It's non-magnetic. Non-sparking. □ Discover all the advantages of competitively-priced Alcoa aluminum rigid conduit: ask your Alcoa-Rome representative or distributor for the facts and figures. Or write to Rome Cable Division of Alcoa, Dept. E3, Rome, N. Y.

CONFORMS TO ASA C80.5-1960—RIGID ALUMINUM CONDUIT AND FEDERAL SPECIFICATION WW-C-540A

ALCOA
ROME CABLE
DIVISION





Vertical cable supports are available for one to six cables and for use on up to 6" conduit. All are UL-listed.

NOW!
POSITIVE SUPPORT
for cables in vertical conduit

Using Adalet fittings on vertical conduit risers makes the support of cables simple, safe and secure.

Simple, because putting the tapered, phenolic grip sections around the cables in the cast-aluminum body immediately sets up a locking action. Dead weight of the cables increases the wedging action, providing a safe means of support. Each phenolic section is long and surrounds approximately 90% of the cable for secure gripping action with minimum unit load on cable insulation. Cast-aluminum body has breather vents to dissipate cable heat, important in high temperature areas or when installing thermoplastic-insulated cable.

Adalet manufactures a complete line of electrical distribution system accessories. Bulletin G1259 gives you the whole story! Write today!

THE
Adalet
MANUFACTURING COMPANY
14300 Lorain Avenue
Cleveland 11, Ohio

Recessed Units (25)

Eight new multiplier downlight recessed units, offering low-brightness, high intensity lighting with 45° cutoff, have been introduced. All housings are made of 20-gauge cold rolled steel in matte black finish, mounted in detachable plaster frames. Reflectors are spun aluminum Alzak and attach to housings by two coil springs. Four units use standard frames: H-4080 prewired and H-4180 unwired, 75-watt, R30 lamp; H-4090 prewired and H-4190 unwired, 150-300-watt, R40 lamp. The other four are flush frame units: H-4082 prewired and H-4182 unwired, 75-watt, R30 lamp; H-4092 prewired and H-4192 unwired, 150-300-watt, R40 lamp. Prewired units are supplied with bar hangers, have 28 cu in. J-box, with one-half and three-quarter combination knockouts, approved for 60° supply conductors.

Halo Lighting, Inc., 4201 W. Grand Ave., Chicago 51, Ill.

Anchors (26)

"Hi-Red" anchors are now available in four larger sizes for use with ¼ in. through ½ in. lag screws. Maximum pull-out from concrete is 4,180 lbs. Anchor is made of Ethyl Cellulose which cold flows as the screw is turned in, to become a permanent mounting. Temperature range is from 78° below zero to 220° above (F). Complete line now includes nine sizes of anchors, the smallest for a No. 4 screw.

Holub Industries, Inc., Sycamore Ill.

Limit Switch (27)

A new line of watertight and explosion-proof heavy-duty limit switches for machine tool and other applications where atmospheres containing explosive gases and dust and moisture present a problem, has been introduced. Switch is available with 19 different kinds of in erchangeable operating heads; in- uding lever operated, plunger and obble stick varieties. Heads in- lude lever type and side push types ith maintained contacts, and lever ype and top and side push types ith spring return contacts. The recision-built operating heads can e mounted in any one of four positions 90° apart. Levers can be lamped in any angular position. wo varieties of contact blocks are vailable; standard block with one ormally open and one normally losed contact; and the neutral position block with either two normally open or two normally closed ontacts.

Allen-Bradley Co., 102-F West Greenfield Ave., Milwaukee 4, Wis.

Rotary Hammer **(28)**

New heavy-duty rotary hammer (Catalog #717) has been added to industrial and automotive line of portable electric power tools. Rated for continuous heavy-duty use, hammer combines a rotary action with a hammering action for drilling holes of ½ in. to 1¼ in. dia. Safety feature of tool is its friction drive that protects operator in cases where bits lock or jam while drilling. Other features include a convenient depth gage, a movable 6 in. side handle that can be mounted on either side for perfect control and heavy-duty ball bearings.

Black & Decker Mfg. Co., Towson 4, Md.

Dimming System **(29)**

New electronic dimming system, called the Master-Slave fluorescent unit, permits the dimming of up to 1200 fluorescent lamps in ceiling fixtures or illuminated ceilings from one central wall control. Dimmer control makes it possible to centrally control light intensity over an area of several thousand square feet of illuminated space from a single standard wall switch box. Three basic components comprise the system. First is a compact wall control, fitting into a standard wall switch box; second, a master auxiliary control; third are slave auxiliary units, subordinate to the master unit. System can be ordered separately as a complete system or in combination with troffers, suspended or ceiling fixtures.

Thomas Industries Inc., Louisville, Ky.

HOLD IT!

Here's the answers
SEND FOR THE NEW 1963
CADDY GAT®
CATALOG
FASTENERS FOR THE CONSTRUCTION INDUSTRY

CADDY® FASTENER Div.
ERICO PRODUCTS, INC.
2070 EAST 61st PLACE • CLEVELAND 3, OHIO
IN CANADA: contact ERICO INCORPORATED.
3100 Lakeshore Blvd. W., Toronto 14, Ontario, Canada

Please send me the NEW 1963 CADDY-GAT Fastener catalog.

NAME ______________________

TITLE ______________________

COMPANY ______________________

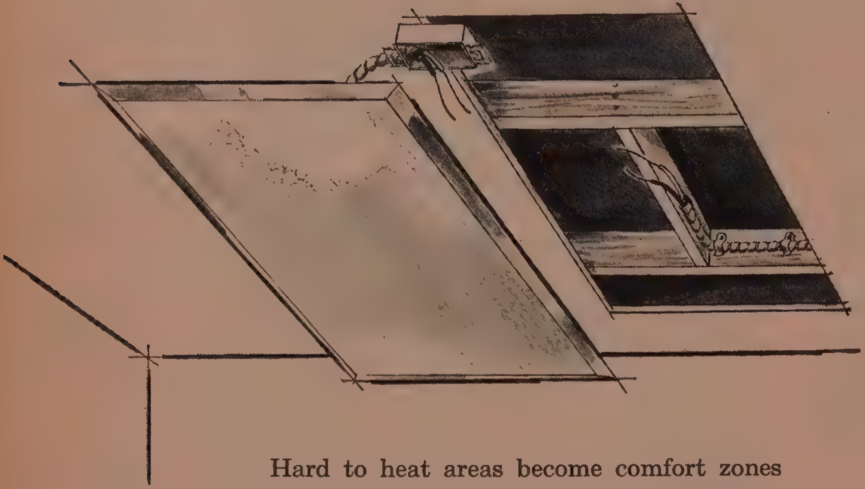
ADDRESS ______________________

CITY ______________ ZONE ________ STATE ________

GOLD MEDALLION HOME
LIVE BETTER ELECTRICALLY

Electric Heat is featured
in Gold Medallion Homes
Equipped by General Electric

No 'hard to heat' areas
with General Electric's
radiant ceiling panels



Accent on VALUE

Hard to heat areas become comfort zones . . . all the space-saving, no-maintenance benefits of embedded ceiling heat can be offered to new and remodeled homes, with General Electric's new radiant ceiling panels.

An exclusive wire grid heating element is embedded in tough plastic. Parallel paths of wire cover the entire panel area, for even, efficient heat distribution. Panel is backed by ¾″ glass fiber blanket insulation.

The 5′ x 2′ x 13/16″ panel can be painted to match ceilings, is controlled by an individual General Electric thermostat.

Pre-drilled holes accommodate wood screws or toggle bolts. Flexible metallic conduit has junction box attached, for quick and easy installation. Panel can be surface or flush mounted in any type ceiling, from plaster to concrete. Weight is only 16 lb—rating, 700 w, 240 v.

The radiant ceiling panel is featured in the all-new General Electric line that brings you a "supermarket" of electric comfort heating equipment—offers the right answer to every heating problem.

For details and specifications, write Sect. 280-05-4, General Electric Company, Electric Comfort Heating Section, Appliance Park, Louisville 1, Ky.

Progress Is Our Most Important Product

GENERAL ELECTRIC

Piston Tool (30)

A new breach-loading powder-actuated piston tool, the Lo-V (low velocity), will handle all ¼-in. drive pins and threaded studs up to 3 in. in length. Fasteners are secured to concrete, blocks and light gauge metal by tool which uses special powercaps. Powercaps are .22 cal. charges encased in thermoplastic housing to maintain peak effectiveness. Oversized trigger permits safe operation, while anti-recoil handle and floating rubber grip makes tool shock absorbing. Weighing less than 5 lbs, tool has 11 components. Operation consists of 6 steps: removing piston cylinder; placing fastener in barrel; putting powercap in breech; putting tool against work and pulling trigger; removing piston cylinder and ejecting powercap.

Nelson Distributor Products Div., Gregory Industries, Inc., Lorain, Ohio.

Grouped Meters (31)

A new line of grouped-meter equipment, for garden or hi-rise apartment buildings, shopping centers or sky-scraping buildings has been announced. This equipment, available in either floor- or wall-mounted construction, is designed for either fusible or circuit breaker protection in services up to 2000 amps. Meter arrangements and related branch circuit groupings can be varied to meet any local utility requirement, building code or customer preference.

Distribution Assemblies Dept., General Electric Co., Plainville, Conn.

Motor Control Centers (32)

New motor control centers are of modular design for minimum installation and future additions of control units. Standard vertical section is an enclosed frame, with compartments for interchangeable control units, 20 in. wide by 90 in.

gh. Depth is 20 in. Control units clude a starter with breaker or sconnect, mounted in a steel en- osure that is inserted between etal separators. One or more ver- cal sections bolted together with movable base channels and top ting angle constitute a control nter. Top and bottom covers may removed for conduit drilling. ypes A and B standard units may ave seven 12-in. plug-in control its on the front side and six 12- . plug-in control units on the back de. All electrical and structural mponents are removable from the ont, allowing control center to be aced against a wall. Main power ne may enter at either top, bottom r side of unit assembly. Types of closures available include NEMA ypes 1, 1A, 3, 5 and 12.

Frank Electric Corp., P. O. Box 863, York, Pa.

onnector (33)

A new Neoprene insulated power T" connection has been added to his line of cable connectors. De- igned to facilitate power trans- ission changes, the "T" is avail- ble for use in paralleling two ower sources for increased output r for use in tapping off an exist- ng cable run. "T's" are also avail- ble for use with a water cooled lectrical system. They are water- roof, shockproof and shatterproof. T's" are available with any com- ination of male and female con- ections. Connectors and power T's" accommodate cable sizes from o. 18 wire to 750 MCM. Litera- ure is available.

Cam-Lok Div., Empire Products, nc., 9213 Blue Ash Road, Cincin- ati 43, Ohio

able Fault Locator (34)

A new 20-kv mobile dc "Hypot," Model 5030, designed for high volt- ge breakdown testing of power ransmission cables, has been intro- uced. This test set provides output urrent up to 0.5 amp dc on inter- ittent service. Hypot operates rom a single phase, 230-volt ac ower line. The dc output, provided y a long-life, solid-state rectifier, s continuously variable from 0 to 0 kv and is rated at 10 kva for ests of ten seconds or less and at kva for continuous duty.

Application Engineering Section, ssociated Research, Inc., 3777 W. elmont Ave., Chicago 18, Ill.

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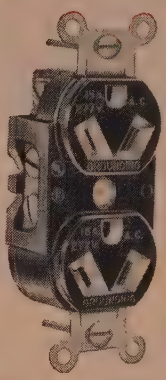
CIRCLE F

277 VOLT

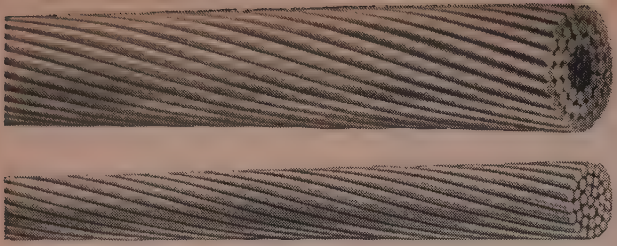
GROUNDING DEVICES

New, 15 amp. 3-wire "U" Ground devices have been designed for lighting applications and other equipment requiring 277 volt circuits. They meet all applicable Government, NEMA & ASA specifications and are UL listed.

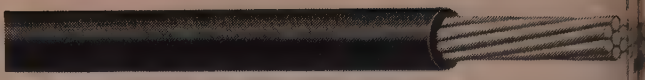


Where interlocking and positive grounding are essential to eliminate accidental disconnects, Circle F's "Circlok" Grounding devices are ideal.

CIRCLE F MFG. CO. TRENTON, N.J.



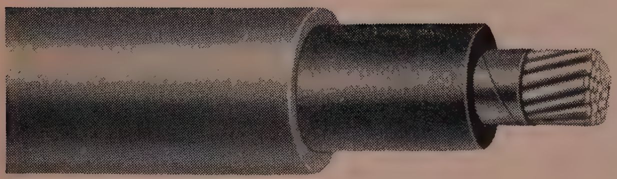
Bare Solid and Stranded Conductors—Aluminum, copper or ACSR in complete range of sizes, tempers, and constructions.



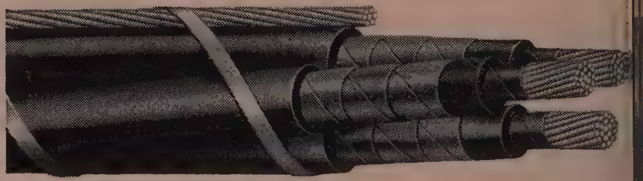
Weatherproof Line Wire—Aluminum, copper or ACSR conductors. Polyethylene and neoprene coverings available.

REYNOLDS

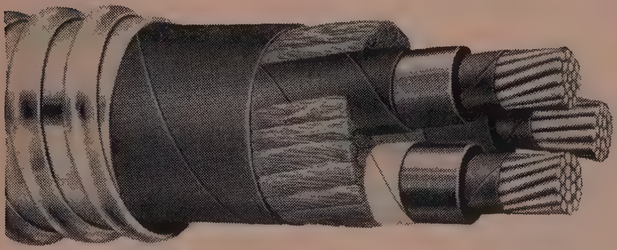
Complete range of types an



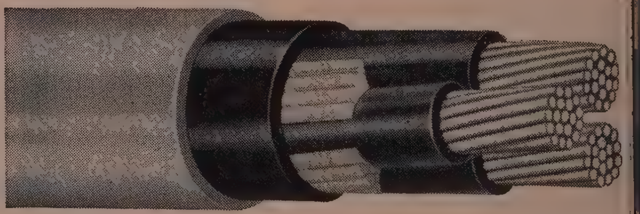
Rubber Insulated Neoprene Jacketed (Non-Shielded) Cable—For conduit, trays, troughs, underground duct, aerial, and direct burial. Aluminum or copper conductors. Up to 5,000 volts.



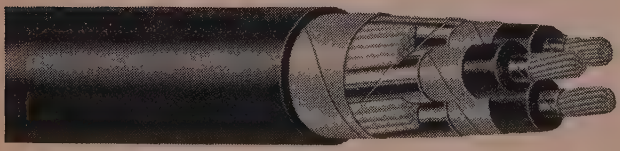
Pre-Assembled Self-Supporting Aerial Cable—Aluminum or copper conductors. Rubber insulated shielded or non-shielded, neoprene jacket. Regular or reverse lay construction. 0-15,000 volts. Various messenger choices.



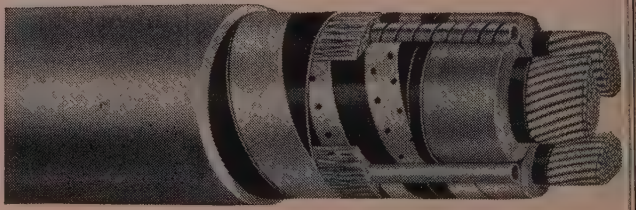
Interlocked Armored Cable—Single or multiple constructions of copper or aluminum conductors. Various insulations and types of armor available.



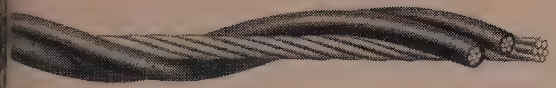
Varnished Cambric Cables—Aluminum or copper conductors. Up to 28,000 volts. Braided or lead sheathed.



Rubber Insulated Neoprene Jacketed (Shielded) Cable—Single or multi-conductor constructions. Copper or aluminum conductors. Ozone resistant butyl insulation. Temperature rating 85° C. 5,000 to 15,000 volts.



Low Pressure Gas-Filled, Paper Insulated, Lead Covered Cables—Aluminum or copper conductors. Self-supervising system. 0-46,000 volts. Tellurium lead sheath with or without outer protective coverings.

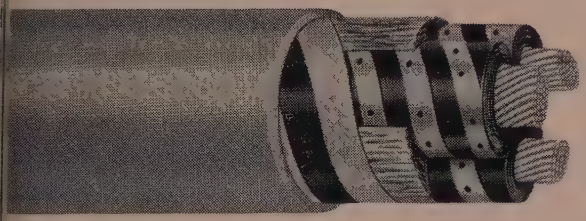


Supporting Service Drop and Sec-ry Cable—Aluminum or copper conductors ted with polyethylene or neoprene. Choice of ngers.

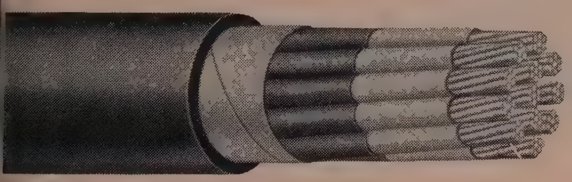
Underground Service Entrance Cable—Single or multi-conductor constructions. Aluminum or copper conductors. For wet or dry locations. Type USE, Style RR, 75° C.

POWER CABLE

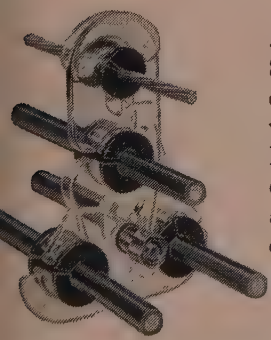
zes to meet your specifications



d Type, Paper Insulated, Lead Cov-l Cables—Single or multiple conductors of inum or copper. Tellurium lead or copper bear-ead sheaths with or without outer protective rings. 0-69,000 volts. Manufactured in accord- with latest AEIC specifications or to meet mer requirements.



trol Cables 600 Volts—Available in a plete range of types and sizes to meet your ifications.



Aerial Cables and Spacers—Aluminum or copper conductors, with various coverings. Highly engineered, molded plastic spacers. For 5,000 through 15,000 volt circuits.

Now—Reynolds can offer one of the most complete packages in the industry! Choose from a wide range of insulated wire and cable; bare overhead transmission cable; bus bar; substations and towers; aluminum conduit; condenser tubes; building products. In addition, these special services are available to Reynolds customers: engineering assistance and on-the-job consultation; design and fabrication assistance; research and laboratory facilities for product development. And, you can always count on fast delivery of your electrical product needs. Contact your Reynolds Distributor, Reynolds Sales Office, or write *Reynolds Metals Company, P.O. Box 2346-ET, Richmond 18, Virginia.*

For details send for brochure, "Reynolds Electrical Products." See address above.

All Reynolds wire and cable meet or exceed the requirements of standard industry specifications

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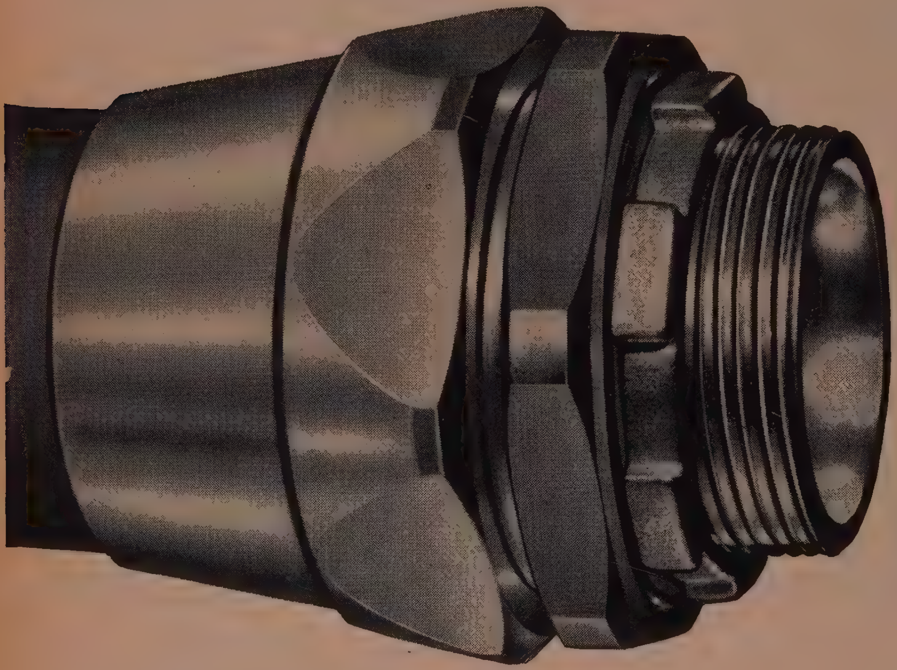
VAP-OIL-TITE CONNECTORS

- for use with liquid-tight flexible, metallic conduit
- absolute water and oil-tight seal — vapor, dust, grit can't penetrate

STANDARD SIZES — ⅜" to 2"
Available in 3 styles — straight, 90° angle and 45° angle. U.L. and J.I.C. approved. Fit both EF and UA conduit. Seven sizes for each style from ⅜" to 2" conveniently packaged in lots of 5 to 100, or by carton...priced right!

LARGE SIZES—2½", 3", 4"
Straight style only. Double O-ring neoprene seals prevent foreign matter penetration—nothing can get **through!** Extra long skirt prevents damage to conduit. Three sizes, 2½", 3" and 4" packaged individually — at the right price!



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The *only* completely reusable connectors for OEM, replacement and maintenance, and machinery applications where a positive seal against water and oil is a must!

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Lamps (35

A new line of beam-controlle mercury vapor lamps, which hav their own metallic reflector buil into the bulb, has been introduced Mercury reflector lamps, which wi be available initially in 400-wat R60 bulb and 1000-watt R80 bul sizes, are expected to have man applications in the commercial an industrial field as well as for recreational lighting. Lamps operate o standard ballasts. A feature is th use of a Lifeguard arc tube. The are made with weather duty oute bulbs.

Westinghouse Electric Corp., Bloomfield, N. J.

Electric Furnaces (36)

A new Unipac series of electri furnaces with three new feature has been announced. They ar finned tubular elements, fan capacity to handle five tons of air conditioning, and use of 2-circuit wiring Half-inch chrome sheafed tubula elements with 1¼-in. steel fins with 3½-fins per inch are rated at 4 watts per sq in. density. 2-circui wiring design makes possible th use of smaller wire. Time sequencing relays prevent power overloads New units retain the 2-stage thermostats and 2-speed blowers in use of all Wesco electric furnaces and are made in 15, 20, 25 and 30 kw capacities, delivering 51,000 to 102,000 Btu's per hour.

Wesco Furnace Div., Northwes Foundry & Furnace Co., 2345 *S. E Gladstone, Portland* 2, *Ore.*

Water Heater (37)

The commercial six-element electric water heater is now available for 440/480 volts, ac, for industry, schools, restaurants and many other applications. Unit is available with three big storage capacities—120-100-80 gallons—and all three units are UL listed. Junction box's electric connection is located on the jacket of the unit. It comes equipped with contactors and features two immersion type thermostats, each controlling a bank of three elements for balanced load on 3-phase current. Unit can be supplied for single phase if desired. Total maximum wattage on the 120-gallon model for 480 volts is 36,000 and 147.0 maximum G.P.H. recovery at 100° rise.

W. L. Jackson Mfg. Co., Inc., P. O. Box 190, *Chattanooga, Tenn.*

NEW General Electric QHT® Transformers

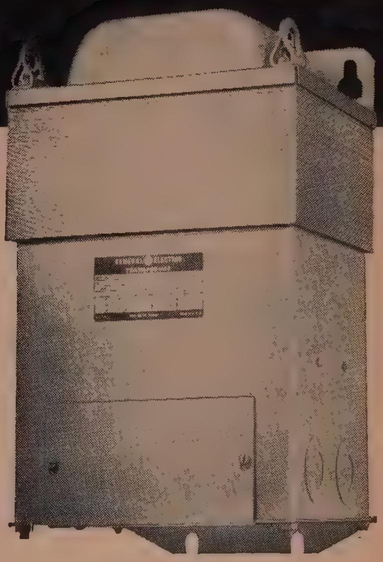
HEAT SHIELD

KEEPS WIRING COMPARTMENT COOL

MEETS NEW

LISTED UNDER REEXAMINATION SERVICE
UL
UNDERWRITERS' LABORATORIES, INC.

REQUIREMENTS



REVISED U.L. STANDARDS FOR SAFETY restrict the type of cable used in making field connections to listed power transformers. To install such a transformer with low-cost 60C rated cable, the type you commonly use, no surface inside the wiring compartment can exceed 60C while the transformer is operating. New QHT dry-types pass this test easily . . . thanks to an exclusive G-E shield between the coil and the wiring compartment. MAKE SURE YOUR TRANSFORMERS MEET U.L. REQUIREMENTS FOR 60C CABLE . . . USE NEW GENERAL ELECTRIC QHT DRY-TYPE TRANSFORMERS. Get all the facts from your nearby G-E Sales Office or distributor. Or write Section 411-26, General Electric Co., Schenectady 5, N. Y.

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You have to go a long way...
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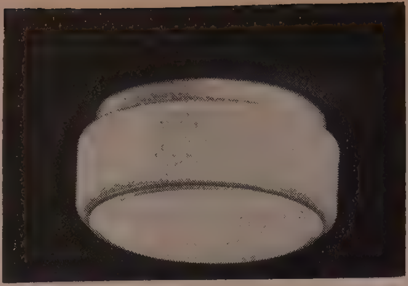
A long way, indeed! For 42 years, Eagle Electric has manufactured electrical wiring devices designed to cut installation time, to lower costs, and to meet the most rigid specifications of QUALITY at fair prices.

Eagle places so much importance on QUALITY that special inspectors are employed to inspect the inspections of customary inspectors. This is a mammoth operation, when you consider that there are more than 1500 different items in the full Eagle line —a long, broad line by any standards.

You have to go a long way to match Eagle QUALITY ... at any price.



Lights (38)

Colored drum lights, for residential and commercial ceiling fixtures, feature a rainbow range of colors consisting of cased handblown glass with white opal glass interiors. The new series includes heat resistant Delrin louvers which produce a 45° light cutoff in both color drum sizes. Diecast aluminum pans have hinged features as well as safeguarding glass retainer rings. Pans are constructed for use on 3¼ or 4 in. outlet boxes. Glass is available in blue on white, yellow on white, flame on white, smoke on white or green on white. Over-all dimensions of the two sizes are 11 in. dia by 5⅜ in. deep, two 60-watt lamps, and 14⅜ in. dia by 5⅜ in. deep, four 60-watt lamps.

Prescolite Manufacturing Corp., 1251 *Doolittle Drive, San Leandro, Calif.*

Metering Enclosure (39)

New service equipment for apartment houses that is completely bussed from main disconnect right through meter to individual apartment breaker is now available. Unit is self contained. Busway is so built to permit a wider variation of placement, and narrow, compact over-all design allows use in smaller space. Enclosures are styled in the manner of building block modulars and may be purchased out of stock as needed to expand any job.

Zinsco Electrical Products, 729 *Turner St., Los Angeles* 12, *Calif.*

Fish Tape System (40)

New system for running pull-lines through conduit and duct systems, called the Vacuum fish tape system, has been announced. It utilizes a Black & Decker vacuum cleaner and may be worked with two operators as follows: Operator No. 1 sets up at a pull box with a vacuum cleaner and the supply of cable to be installed. He connects the vacuum cleaner hose to any of the conduit ends and turns it on. Operator No. 2 then locates the remote end of the conduit by the

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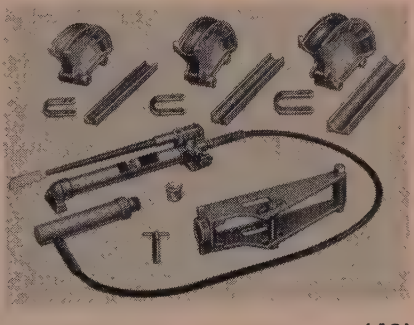
sound of the in-rushing air created by the vacuum cleaner's suction. A polyfoam line carrier, attached to the end of a poly (synthetic) rope, is then fed into the conduit by operator No. 2 and carried back to operator No. 1 by the suction force of the vacuum cleaner. Operator No. 1 then fastens the wire or cable onto the poly rope, operator No. 2 pulls it back through the conduit, and the wiring job is completed. The above steps are repeated until all runs in the pull box are completed. Besides wiring the conduit, the system cleans the conduit through the suction force of the vacuum cleaner.

Black & Decker Mfg. Co., Towson 4, Md.

Thermoelectric Unit (41)

A new thermoelectric temperature stabilizer with its own power supply is now available. It is especially designed to solve problems in temperature stabilization of electrical and electronic circuits and components. Unit is designed for bench service and operates from a 110-volt 60-cycle power source. The same unit, with power supply, may be obtained for relay rack mounting in a standard 19-in. relay rack configuration.

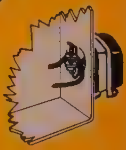
Carter - Princeton, Electronics Div. of Carter Products, Inc., Princeton, N. J.



Bender Set (42)

A new thinwall bender set incorporating a precision angle indicator has been introduced. By indicating the start and degree of each bend, this new EnerPac hydraulic unit permits more accurate bending of thinwall conduit. The set, designated as Model S-34 and designed to handle thinwall conduit of 1¼ in. through 2-in. size, also features new aluminum shoes. Set comes complete with power unit, accessories, storage box and bending instructions.

Blackhawk Industrial Products Co., Butler, Wis.



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Handi-Mount
Transformers
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"Perfection Is Not an Accident"

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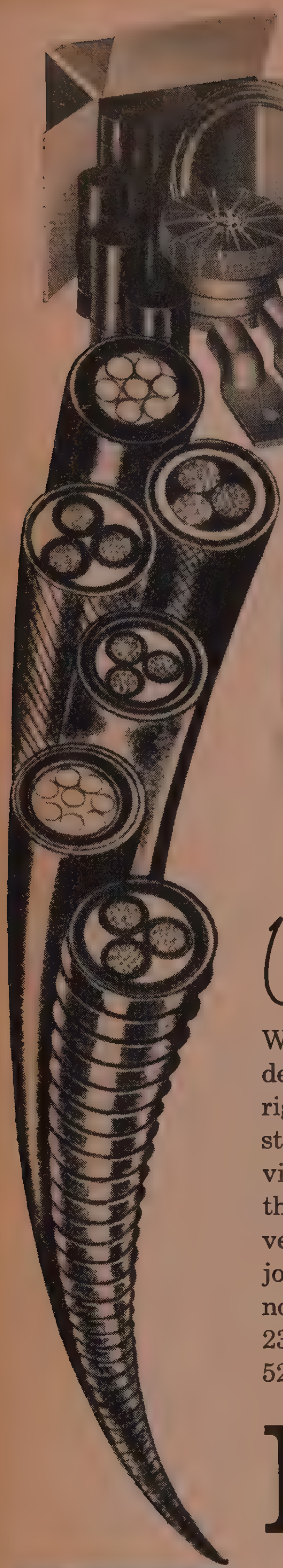
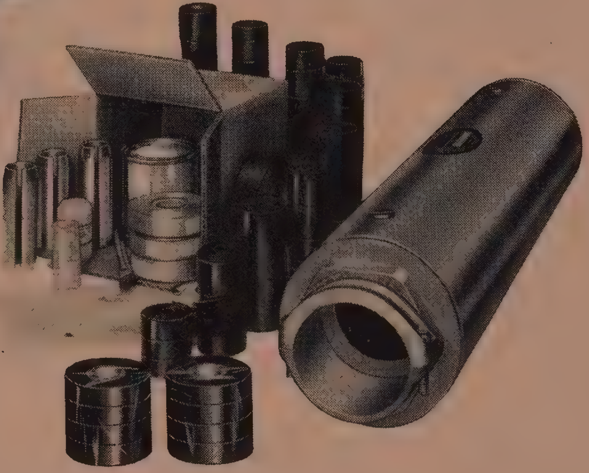
NAME THE CABLE...





PLM ACJD-15 Splicing Kit for 15 kv DG insulated, interlocked armored cable.

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We'll wrap up *all* the details for making properly designed splices and terminations. Assemble the right materials for each. Supply drawings and step-by-step instructions. Deliver them, in individually packed and sealed kits, where you want them, when you want them. No stocking or inventory worries. No guesswork or time lost on the job. You name the cable: interlocked armored, non-metallic sheathed, lead-covered — through 23 kv. We'll do the rest! Full details in new 52-page PLM Catalog 301A. Write for copy.

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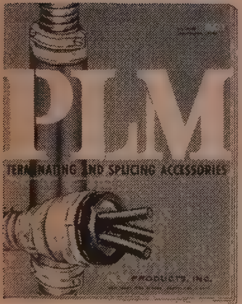

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Name ____________
Company ____________
Address ____________
City ____________

Program Instrument (43)

A new program instrument, 23000-S Series, designed and engineered to meet requirements o signal instruments, has been announced. Instrument is basically a completely automatic switch which can be preset to close an electrical circuit at any desired five minute interval of any 24-hour period. Program instrument is provided with a 24-hour dial and Skip-A-Day wheel with ½ to 1 day skips of any day of the week in 12 hour segments, 6 AM to 6 PM. It features an adjustable main signal and prewarning signal range. Bulletin No. 6213 is available.

Paragon Electric Co., Inc., Two Rivers, Wis.

Tape (44)

Tesa Foam Stik Tape, a self-adhesive, urethane foam plastic tape absorbs shock and vibration and protects components. The tape's cushioning and insulation features improve the installation of electrical apparatus, including the lighting field, such as luminaires, troffers, strip ceiling mounts, diffusers, etc. Available in roll form in a variety of widths, lengths and thicknesses. Colors are white, black and grey.

United Mineral & Chemical Corp., 16 Hudson St., New York 13, N. Y.

Room Control System (45)

A new pushbutton status system providing up-to-the-second information on the readiness for occupancy of hotel or motel rooms, has been introduced. The electronic system is equally adaptable to pinpointing available rooms or vacated spaces in hospitals, bowling alleys and large office buildings. Complete "at a glance" house control for 150 rooms is provided on a panel 33 in. long and 15 in. high. A single light for each room tells the front desk whether it is occupied, waiting to be made up or ready for a new guest. Models for larger or smaller installations are also available.

Metro-Tel Division of The Grow Corp., Plainview, N. Y.

Outdoor Fixtures (46)

New Plaza line of outdoor lighting fixtures and poles for residential, commercial and institutional stallations has been introduced. ixture is fabricated from spun luminum shapes, and is available or filament, reflector or mercury mps. Fixture mounts directly to ole with a cast aluminum pole dapter. The line also includes hree types of poles. The bolt ounting type and the concrete ounting type are available in six odels each, ranging from 4 to 14 t in height. A pole with mercury ransformer base is also available or bolt mounting. It comes in 10-, 2-, or 14-ft heights.

Guardian Light Co., 500 *North lvd., Oak Park, Ill.*

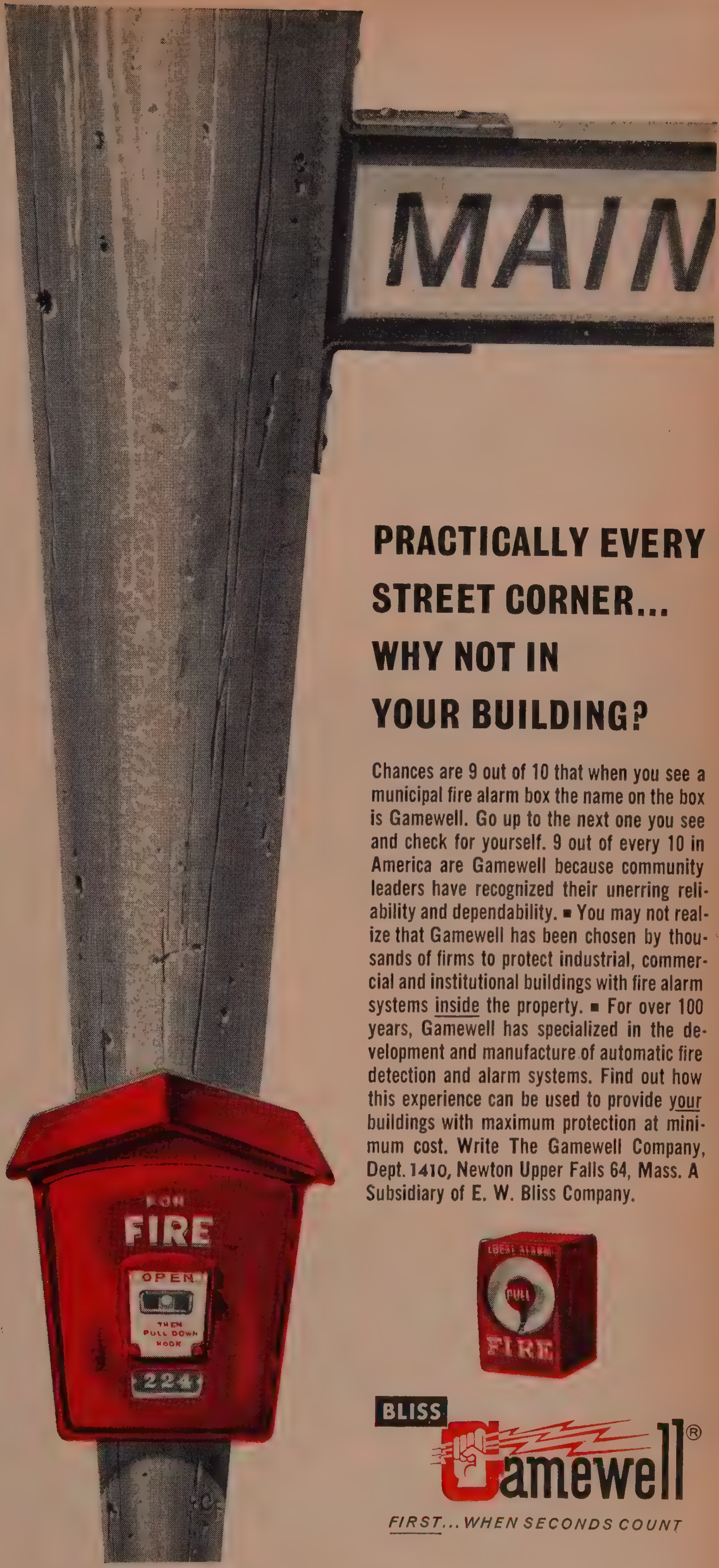
Product Briefs

(47) A new **control system** for ranes, hoists and other high-production materials handling equipment, known as the Tri-Torque Crane Control, which gets dc performance with standard ac motor, has been developed by I-T-E Circuit Breaker Co., Philadelphia, Pa. . . . (48) Allen-Stevens Conduit Fittings Corp., Woodside, N. Y., has introduced symmetrical pull corner elbows for ½-in. conduit.

(49) A stud **terminal,** designated Type LV "Autovalve," with a nonexplosive thermal dropout and handwheel terminals, is now available from Westinghouse Electric Corp., Distribution Apparatus Div., Pittsburgh, Pa. . . . (50) Cutler-Hammer Inc., Milwaukee, Wis., has available a complete line of ac reactor **crane controls** for hoist, bridge and trolley service featuring static operation, speed regulation, stepless control and cushioned starting.

(51) A new hook-on **watt-var-meter** which can be used to obtain simultaneous single chart records of watts and vars on polyphase circuits up to 13.2 kv has been introduced by General Electric Co., Schenectady, N. Y. . . . (52) Cutler-Hammer Inc., Milwaukee, Wis., has developed an industrial **static switching system** which provides direct performance of basic logic functions and built-in state indication, making possible straightforward, easily followed circuit design.

(53) New **receptacles and caps** for TV and radio antenna systems have been introduced by Pass and Seymour, Syracuse, N. Y. . . . (54) Moe Light Div., Thomas Industries Inc., Louisville, Ky., has introduced new contemporary pendant **lighting fixtures.**



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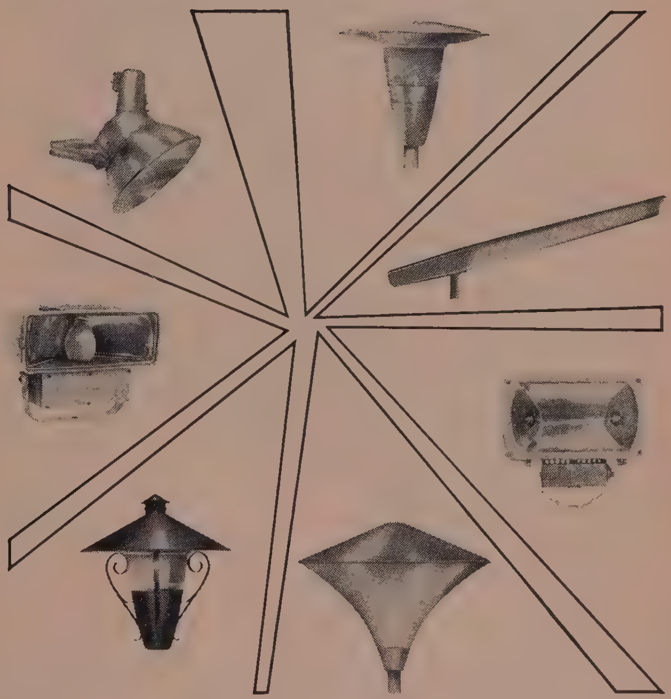

ACCENT ON VALUE The General Electric luminaires that added the values

Seven examples of how imaginative planners are using good-looking General Electric luminaires to add value to their projects. For more information on the industry's most complete line of luminaires and poles, see your G-E Area Lighting Agent or write for our new designer's and buyer's guide to Sect. 460-19, General Electric Co., Schenectady, N.Y. *Outdoor Lighting Department, Hendersonville, North Carolina*

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Catalogs & Bulletins

(55) MOTOR CONTROLS. Bulleti 601 covers squirrel cage, woun rotor and synchronous motor starters for indoor and outdoor application with high and low voltage motors to 10,000 hp. Ideal Electri and Mfg. Co.

(56) GROUND RODS. Copper-bonde ground rods, recommended fo utility transmission and distribution lines, substations, communications lines, towers, missile site and lighting protection systems, ar described in Bulletin 6207. Jaspe Blackburn Corp.

(57) ELECTRIC HEAT. 16-page catalog describes line of residential an commercial electric heating equipment including introduction of series of convection baseboard, uni blower heaters and radiant ceilin cable. Hunter Div., Robbins & Myers, Inc.

(58) FLUORESCENT LAMP BALLAS cross reference guide indicates th Universal "Service Guaranteed ballast catalog number equivalent for fluorescent lamp ballasts o other manufacture. Universal Mfg Corp.

(59) RECORDERS. 12-page Bulleti GEA-6933B describes full line o direct-acting and servo-operate switchboard and portable recorders. General Electric Co.

(60) TIME CONTROLS. Bulletin 613 entitled "Make Every Home Magically Automatic" describes hom automation applications, the tim controls to do the job and the cos of each control. Paragon Electri Co., Inc.

(61) COMMUTATORS. Catalog No 67 includes complete specificatio and pricing information on over 50 stock replacement commutators Toledo Commutator Co.

(62) SILICONE insulating components to rewind motors for improved performance are describe in Brochure 07-006. Dow Cornin Corp.

(63) INDUSTRIAL LIGHTING problems are presented with solution in 4-page folder including nigh photographs of "Wide-Lite" Mercury vapor floodlight applications a outdoor industrial areas, from dam construction sites and power com

ny switchyards to storage areas d gasoline processing plants. ide-Lite Corp.

4) LAMPS. High-efficiency fluo-scent lamps are described in 12-ge booklet A-7370. Westinghouse lectric Corp., Lamp Div.

55) ELECTRIC HEATERS. Chroma-x large-flanged electric immersion eaters for large-volume heating, igh pressure and temperature ap-lications are presented in Bulle-n PD111. Edwin L. Wiegand Co.

66) HOME LIGHTNING PROTECTOR s described in Bulletin GED-4835, lustrating how damage can be one to electrical appliances and iring by lightning entering hrough the electric service wires. eneral Electric Co.

67) CONDUIT FITTINGS, circuit ontrols, plugs and receptacles and ighting equipment are described in 36-page Catalog No. 62. Pyle-National Co.

(68) COMMUNICATIONS SYSTEMS or nursing homes and senior citi-ens retirement centers are de-scribed in new bulletin. Communi-ations Systems Div., Dukane Corp.

(69) LIGHTING catalog covers complete line of die cast aluminum weatherproof fixtures for sealed beam lamps. Moldcast Mfg. Co.

(70) SHOPPING CENTER LIGHTING. 14-page Bulletin GEA-7585 details how to apply outdoor lighting to shopping center parking lots, malls, walkways, entrances, exits, building facades, signs, service areas and fountains. General Electric Co.

(71) SILICONE rubber insulated form-wound motors are illustrated in 4-page Brochure 09-002. Dow Corning Corp.

(72) POWER CONTROLLERS. Bulletin F-10649-1 tells the story of the compact silicon controlled rectifier type power controller capable of handling up to 10 kva on single phase applications. Barber-Colman Co.

(73) LIGHTING. 48-page catalog contains newly revamped line of fluorescent and incandescent lighting fixtures for indoor and outdoor use. Wheeler Reflector Co., Inc.

(74) TRANSFORMER. Bulletin 61C1283 describes latest A-C concept in pole-top distribution transformer design. Allis-Chalmers Mfg. Co.

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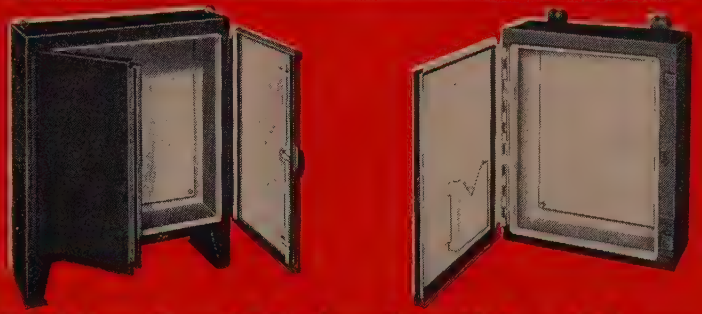

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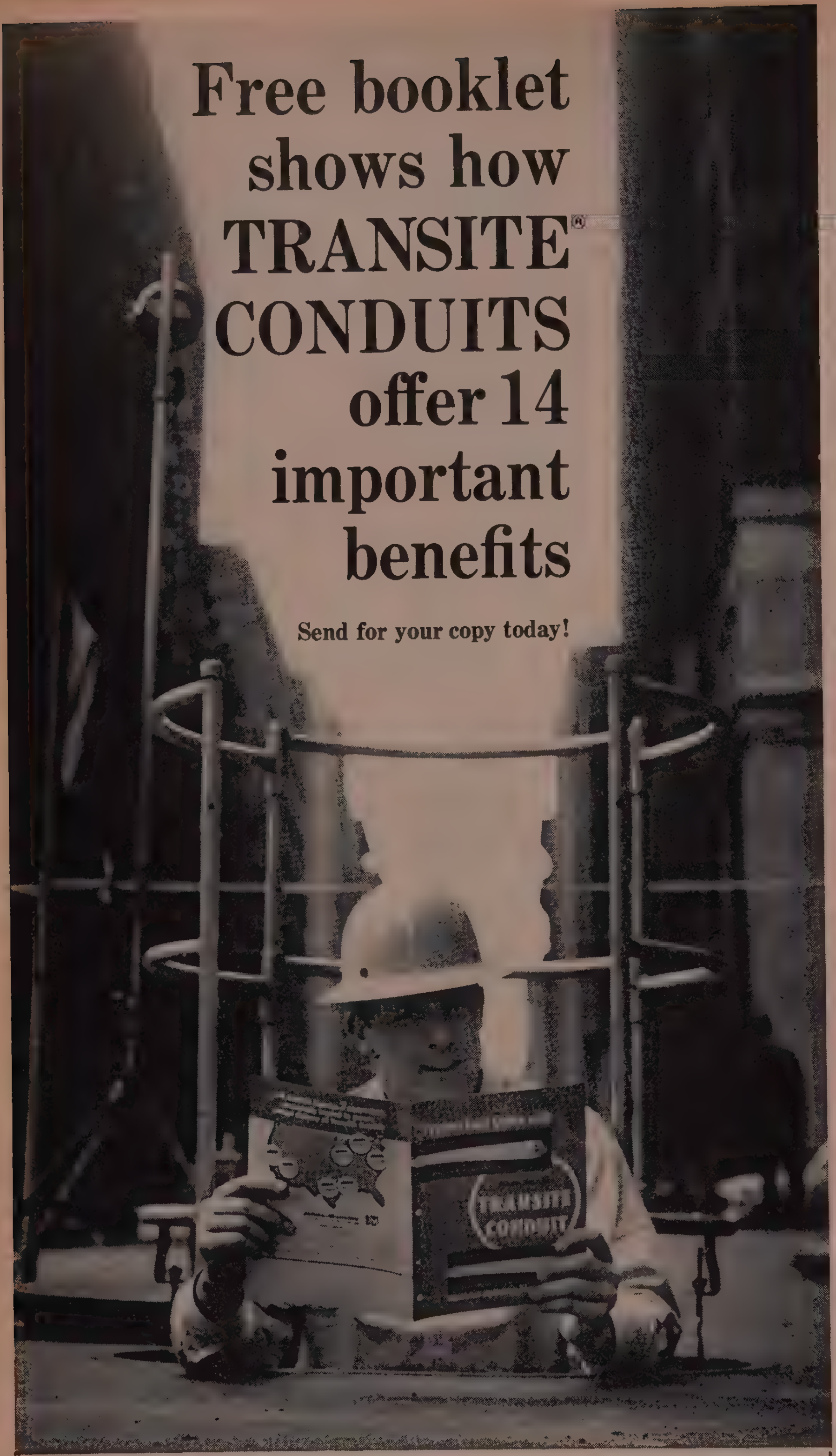
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(75) CONTACT CLOSING DEVICES. A technical comparison of new stored-energy mechanisms with conventional solenoid-actuated devices for closing contacts of medium-voltage air circuit breakers is contained in 8-page Bulletin 2803-1A. I-T-E Circuit Breaker Co.

(76) SWITCHES. 56-page Catalog 57-S1 describes mechanically and magnetically held switches which automatically transfer power and lighting circuits from a normal to an emergency source in case of failure. Automatic Switch Co.

(77) DC SOLENOIDS. Bulletin PRB-31S describes line of over 3000 models of standard linear dc solenoids. Tec Magnetics.

(78) ELECTRICAL WIRING devices, switches and receptacles, transformers, lamps and specialty products are illustrated in 100-page catalog. Eagle Electric Mfg. Co., Inc.

(79) PORTABLE INDICATING INSTRUMENTS. 16-page Bulletin GEA-7727 describes ac and dc portable indicating ammeters, voltmeters and wattmeters for use in utilities, universities, repair shops and laboratories. General Electric Co.

(80) SERVICE CONTROL for residential, commercial and industrial applications is described in 40-page "Safetybreaker Selection Guide." Cutler-Hammer Inc.

(81) TIME SWITCHES for automatic control of plant operations are described in 6-page Intermatic Industrial Catalog NR-62. International Register Co.

(82) MERCURY LIGHTING. 4-page Booklet A-7359 entitled "A Guide to the Selection of Lifeguard Mercury Lamps" covers commercial, industrial, general outdoor and roadway lighting. Westinghouse Electric Corp., Lamp Div.

(83) OUTDOOR LIGHTING CONTROL, the new Duo-Volt 6690, is described in 4-page bulletin. Fisher-Pierce Div., Sigma Instruments, Inc.

(84) GROUPED METER EQUIPMENT. Bulletin GEA-6741 gives details of rating and dimensions as well as diagrams of meter socket arrangements and general construction of the variety of floor- and wall-mounted designs available for garden type or high-rise apartment construction, office buildings and shopping centers. General Electric Co., Distribution Assemblies Dep

(85) **LIGHTING.** Catalog S1-163 lists over 40 new lighting fixtures for the home: a series of one and three lite cord and chain pendants; and a series of traditional, colonial and modern five lite chandeliers with matching wall and ceiling mounts. Del-Val Mfg. Co.

(86) **POWER SUPPLIES.** Fourteen different typical installations of silicon power supplies are shown in Bulletin 701 describing Power Plus line. Richardson-Allen Div., Kollsman Instrument Corp.

(87) **FLOODLIGHTS.** Bulletin describes high power INA-10 floodlights that project a rectangular beam. Infranor of North America, Inc.

(88) **LIGHTING.** Catalog presents information on more than 560 fixtures and variations of commercial and industrial line. Curtis-Electro Lighting, Inc.

(89) **PRESSURE SWITCHES.** Engineering Manual, dealing with pressure actuated switches, their associated phenomena, and the terminology they have necessarily developed, is a useful tool for anyone concerned with the problems involved in sensing hydraulic and pneumatic pressures. Meletron Corp.

(90) **TROFFER LIGHTING.** 12-page catalog describes new recessed troffer illumination design. Neo-Ray Products, Inc.

(91) **LIGHTING.** Standard and basic fixtures, for apartment houses, housing developments are illustrated in Econo-Wise catalog. PrestigeLine, Inc.

(92) **WIRE MARKERS.** 8-page stocklist covers entire line of self-adhering E-Z code wire markers available $\frac{1}{4}$ in. wide by $1\frac{1}{2}$ in. in length to a sub-miniature $\frac{1}{16}$ in. by $\frac{3}{16}$ in. size. Westline E-Z Code Div., Western Lithograph Co.

(93) **EXPLOSION-PROOF LIGHTING.** The "where and why" and the requirement behind the design of electrical products for Class I, Group B hazardous locations containing hydrogen, is presented in Bulletin 659. Pyle National Co.

(94) **INSTRUMENTS.** Bulletin 1250 describes resistance measuring instruments consisting of "Megohmer" insulation testers, ohmmeters, milliohmmeters, etc. Herman H. Sticht Co., Inc.

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FROM 15 A., 125 V. to 60 A., 250 V.

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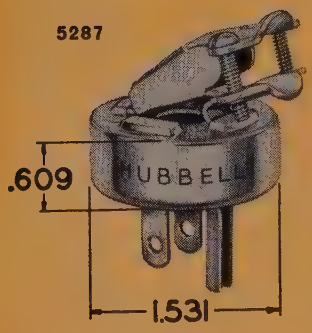

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CORD GRIPS

The cord grips on this cap can be adjusted in any one of 4 positions to permit entrance of the cord from the top, bottom, left, or right, whichever is safest and most convenient. As a result, unit takes less space, snugs behind heavy equipment without cramping the cord; makes wiring easier, neater and safer.

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Reader's Quiz

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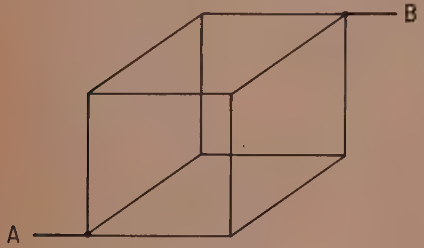
Cube Resistance Problem

QUESTION S41—Note the accompanying drawing of a cube where each of the 12 line segments represents a 1-ohm resistor. What would



the resistance be across A and B, and what formula would be used to find the answer?—R.S.

ANSWER TO S41—The answer is $\frac{5}{6}$ ohms and the formula would be: $R_o = \frac{5}{6} R$, where R is the resistance of each segment of the cube. The formula applies *only* to cases where all 12 segments have equal resistances.

The formula can be derived by noting that the total current I_o splits into three equal parts at A, and again into two equal parts at the next junction and then combines in the reverse order until point B is reached. Let R represent the resistance of each segment of the cube and let E_o represent the sum of voltage drops across any one path from A to B, then:

$$R_o = \frac{E_o}{I_o} = \frac{\frac{I_o}{3}R + \frac{I_o}{6}R + \frac{I_o}{3}R}{I_o}$$

$$= \frac{1}{3}R + \frac{1}{6}R + \frac{1}{3}R = \frac{5}{6}R$$

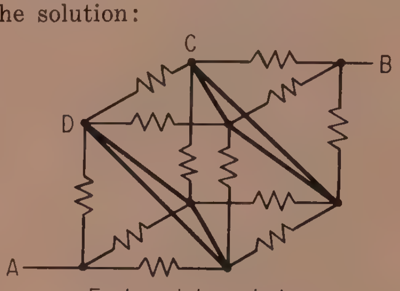
As an example, where each segment of the cube is 1 ohm, $R_o = \frac{5}{6} \times 1$ or $\frac{5}{6}$ ohm. If each segment is 6 ohms, $R_o = \frac{5}{6} \times 6$ or 5 ohms, etc.—J.J.O.

ANSWER TO S41—This problem is a classical example used in applying network theorems, and appears in many places. One of the more conventional ways of solving this network problem is by the use of wye to delta transformations.

The following solution, however, requires much less labor. This solution, to the best of my knowledge, was first submitted by Mr. Edward Partridge of Allen B. Dumont Lab., Passaic, N. J. It appears in the publication "Ingenious Mathematical Problems and Methods" by L. A. Graham, Dover Publications, Inc., New York, N. Y., 1959.

Mr. Partridge's solution takes advantage of the symmetry of the cube as well as the principle of equipotential points.

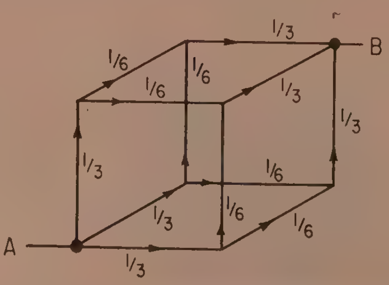
Using Mr. Partridge's following sketch, I quote his explanation of the solution:



Each resistor = 1 ohm

"Short the three corners nearest to corner "A" together, and the three corners nearest to corner "B" together. This can be done without disturbing the current flow since all three of each of shorted points are equipotential (or symmetrical) points, and the shorts will carry no current. Then there are three equal resistors in parallel between points A and D, six between D and C, and three between C and B; the required resistance (joint) being $\frac{1}{3} + \frac{1}{6} + \frac{1}{3}$ or $\frac{5}{6}$ ohm (combined)".—W.L.F.

ANSWER TO S41—Assume 1 amp flowing from "A" to "B" (using Kirchoff's Law), the current divides $\frac{1}{3}$ amp to each leg, then $\frac{1}{6}$ amp to two legs, then combines to make $\frac{1}{3}$ amp to reach "B." Take any path and we have voltage drops of $\frac{1}{3}$ volt ($\frac{1}{3}$ amp × 1 ohm) + $\frac{1}{6}$ volt ($\frac{1}{6}$ amp × 1 ohm) + $\frac{1}{3}$ volt ($\frac{1}{3}$ amp × 1 ohm) = $\frac{5}{6}$ volt. Then $R = E/1 = \frac{5}{6} \div 1 = \frac{5}{6}$ ohm.—J.L.



Editor's Note—The cube resistance problem in Question S41 drew a fabulous response from our readers. From the comments received, it appears that many readers enjoyed this unique problem in electrical fundamentals as a change of pace. Most of the answers were based on the easier methods of solution, while a few provided the solution by the more complex methods. Unfortunately, due to the length of the more rigorous methods, we are unable to publish them although we are forwarding the various types of correct solutions to R.S. There are many different ways to solve the problem, some of which include 1) equivalent series-parallel circuits; 2) Kirchoff's and Ohm's Laws; 3) the "Node" method; 4) determinants; and 5) wye to delta transformations. We are sure that R. S. will enjoy reviewing the various methods of solution as much as we did. And for those who submitted incorrect answers, the solutions published should prove helpful.—J.H.W.

Conduit Heating

QUESTION T41—We have a problem where our conduit runs to two air conditioners seem to get hot for no apparent reason. The building is served by 3-phase, 4-wire, 120/240 volts delta. The condensers are 3-phase, 230-volt, FL amps 28 on compressors, 2.8 on fans. We have three No. 8 TW wires in ¾-in. EMT to each unit with proper fittings made up tight. Lengths of runs are approximately 75 ft. with about 35 ft concealed above suspended ceiling and wood deck and joist construction. Clamp-on ammeter readings at both ends check out 30 amps (L1), 30 amps (L2), and 28 amps (L3). Voltage reads 238 volts. The wires in the disconnect switches at either end feel normal to the touch. I say the wire is large enough for the load and length of these feeders. Is this slightly higher voltage causing our trouble? Are we complying with Section 430-22 of the code?

We will replace the No. 8s with No. 6s in 1-in. conduit but would

e your explanation on what we
ve overlooked.—J.N.

NSWER TO T41—If the con-
led space is at the roof level,
1 may find that the conduit
uld feel warm without wires
cause of a high surrounding
nperature. A carrying capacity
40 amps for a No. 8 TW wire
based on the premise that not
re than three such conductors
ll be contained in a single con-
it or cable, and that the room
nperature does not exceed 86°F.
om your statement it is as-
med that neither ¾-in. conduit
ntains more than three conduc-
rs. This leaves the temperature
ctor. If the temperature in the
ace where the conduit is in-
alled exceeds 86°F, then you
ould apply the derating factors
ven at the bottom of Table 310-
of the 1959 NEC. Over 86°F
d up to 104°F, the rated carry-
g capacity of No. 8 TW conduc-
rs in conduit would be 40 amps
0.88 or 35 amps. From 105°F
113°F the carrying capacity
ould be 40 amps × 0.71 or 28
nps, etc., where finally any tem-
rature over 131°F would negate
e use of any TW wire regardless
size. Weighing these factors
ll determine whether or not you
e complying with Section 430-22,
nich calls for conductors with a
rrying capacity of 125% of the
ll-load current rating of the
otor. Because many roof spaces
get exceptionally hot during the
mmer, I would check the tem-
rature in this area before looking
r other causes of heat. From the
mperature readings taken, you
n apply the applicable rules of
rticle 310 in determining the
oper size and insulation types
itable for the branch-circuit con-
ctors in question.—H.S.

NSWER TO T41 — Applying
andard voltage-drop calculations
the factors given in your state-
ent, it appears that the VD be-
veen any two wires of each 3-wire
phase branch circuit is about 3
olts, which represents a 1.25%
rop on a 238-volt supply. From
is quick calculation, it would
em that increasing the size of
e circuit conductors from No. 8
No. 6 will not solve your heating
roblem. Also the 238-volt supply
ould not be a factor of concern.
The cause of the trouble could be
ie to magnetic induction. By that
mean it is possible that the two
in. (steel) EMT runs terminate
a common metal enclosure, such

CUTS FROM ANY ANGLE

Cuts flush to any surface, and flush with any surface to right or left . . . plunge cuts and does everything else you expect of a saw-of-all-work designed to handle every type of installation and maintenance sawing job.

Two-Speed Control increases accuracy of work and versatility of tool. HI speed for cutting through wood, plaster, nails, plastic and composition materials; LO speed for cutting wide range of metals.

Perfect balance and vibration-free operation mean more comfort, less fatique and money saved by minimizing blade breakage.

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Designed to last longer. Silver alloy contacts have built-in wiping action for continued circuit fidelity. Contact bounce is minimized by unique magnet suspension that eliminates shock and jar.

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Modular design cuts la out and constructi costs. Control panels can built with a modular a proach for the entire re section. Every single BF lay uses the same base pla No relay extends beyond base plate. This is true of

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rd's Cleveland Engine Plant In the past year, each relay s operated about 3,000 times r day. Has their performance en satisfactory? Ford is in- alling a duplicate transfer ne—again using the new estinghouse BF relays.

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nterested in knowing more out these cost savers? Ask ur Westinghouse repre- ntative for a copy of Book- B-7365, or send us the ached coupon for com- te information. *You can be e . . . if it's Westinghouse.*

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. . . for locating faults on lead-covered cable installed in ducts—also on aerial and buried cable

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25kv set with detector

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15kv and 5kv sets available with dolly for one-man operation

Three ratings available:
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Each of the three models of Biddle Cable Fault Locators consists of a high voltage d-c impulse transmitter requiring only 600va input power at 115v, 60cps supply voltage for plug-in operation.

They are complete tracer current outfits in which high current at high voltage is used to break down the fault for external identification by means of a pickup coil and detector. The transmitters combine high power output with low energy input and with comparatively small size and weight.

Auxiliary equipment includes electromagnetic and audio detectors. A high voltage bridge for fault locating and loop resistance measurements is also available.

For information on all Biddle Cable Fault Locating equipment write for Bulletin 65-ECM.

B200

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Electrical Testing and Speed Measuring Instruments
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as a junction box or cabinet at o near the air conditioners. Heatin by induction could result if th phase conductors are interconnected at this end so as to provid a condition where each 3-wir branch circuit serves each air conditioner through two conduits instead of one. Therefore, check thi possibility by examining the lead and their ultimate connections a this end of the circuit. If you fin the wires transposed, as previousl stated, make the proper correction at this end, and this will solve you problem.—F.A.G.

Lux Conversion Factor

QUESTION U41—I am working o a project to be built in German In the specification, the require lighting intensities are given i "Lux" and I would like to find ou the equivalent footcandles. searched for the conversion facto in many handbooks but cannot fin it.

I would appreciate getting th information and finding out th basis of the unit "Lux."—J.A.

ANSWER TO U41—The uni "Lux" as defined in IES Lightin Handbook Sec. 3-7: "Lux, lx; th unit of illumination when the mete is the unit of length; equal to on meter-candle or one lumen pe square meter."

The unit of illumination to whic we are accustomed is the foo candle or one lumen per squa foot.

Therefore the ratio of the "Lux to the "footcandle" is equal to th ratio of the square meter to th square foot or 1:10.76, i.e., 1 equals 10.76 lux and 1 lux equa 0.0929 fc.—J.D.C.

ANSWER TO U41—Wherever th metric system is used, the "Lux" the standard unit to denote illum nation. It is equivalent to th meter-candle and constitutes the i lumination on a surface one squa meter in area which has a unifor light distribution of one lumen. O footcandle is equal to 10.75 lux. C.J.K.

ANSWER TO U41—The origin a values of the European term "Lu may be found in I.E.S. Lightin Handbook. The basic relationshi of lux, a unit of illumination, a as follows: 1 lux = 1 meter cand = 1 lumen/square meter. Since footcandle = 1 lumen per squa foot, it can be determined that 1 l = 10.76 fc.—M.N.

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You get full adhesive power — where you want it — with Bull Dog Vinyl Plastic Tape. The adhesive is anchored to the face by a special process. It does not pick off, no matter how you handle the tape. This means Bull Dog Vinyl Plastic Tape sticks fast, stays tight.

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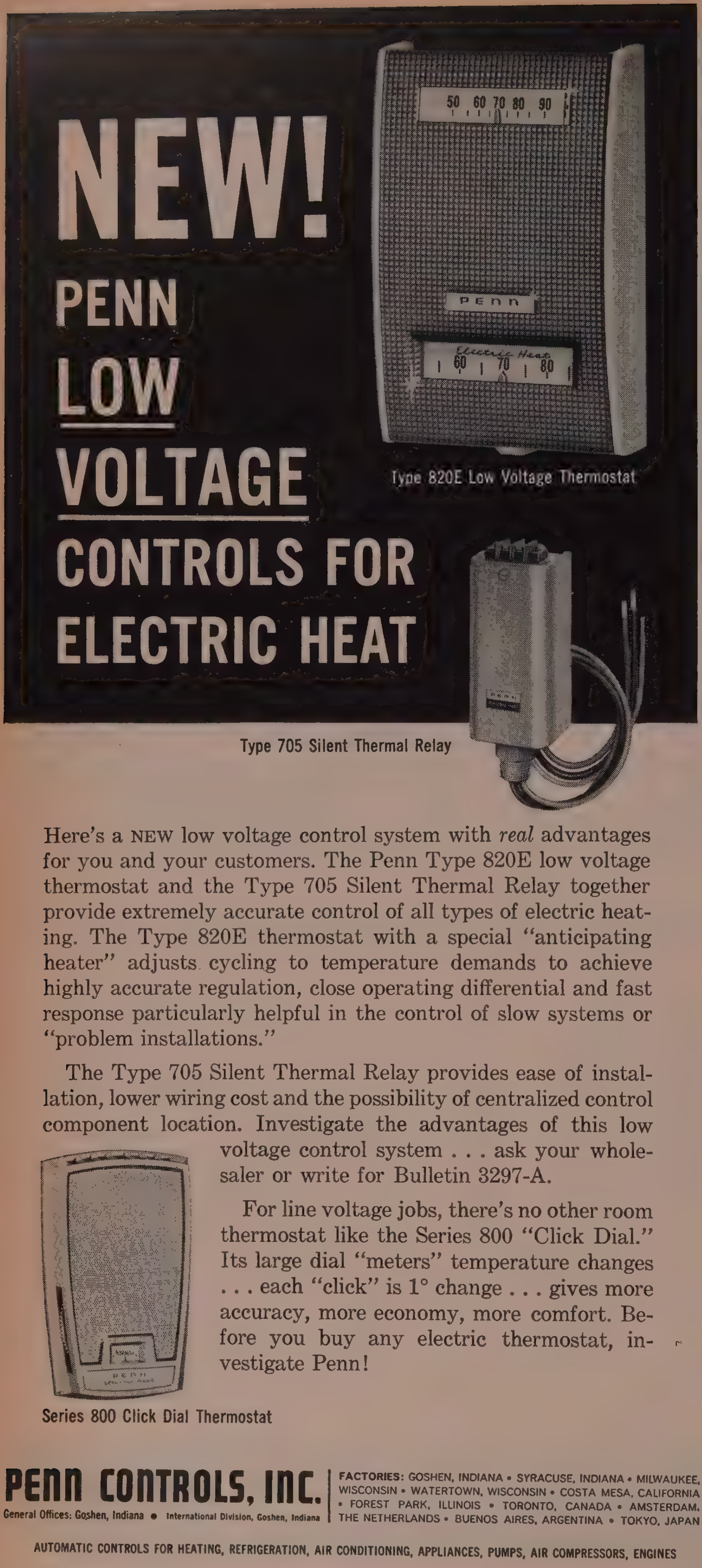
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Type 820E Low Voltage Thermostat

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Here's a NEW low voltage control system with *real* advantages for you and your customers. The Penn Type 820E low voltage thermostat and the Type 705 Silent Thermal Relay together provide extremely accurate control of all types of electric heating. The Type 820E thermostat with a special "anticipating heater" adjusts cycling to temperature demands to achieve highly accurate regulation, close operating differential and fast response particularly helpful in the control of slow systems or "problem installations."

The Type 705 Silent Thermal Relay provides ease of installation, lower wiring cost and the possibility of centralized control component location. Investigate the advantages of this low voltage control system . . . ask your wholesaler or write for Bulletin 3297-A.

For line voltage jobs, there's no other room thermostat like the Series 800 "Click Dial." Its large dial "meters" temperature changes . . . each "click" is 1° change . . . gives more accuracy, more economy, more comfort. Before you buy any electric thermostat, investigate Penn!

Series 800 Click Dial Thermostat

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AUTOMATIC CONTROLS FOR HEATING, REFRIGERATION, AIR CONDITIONING, APPLIANCES, PUMPS, AIR COMPRESSORS, ENGINES

Can You Answer These QUESTIONS?

QUESTION A42 —At our plant we have one 12-kv primary feeding two banks of transformers (three 200 kva, and three 250 kva) which gives us two secondaries of 480 volts in the plant. This is a simple radial system. The occasion came to check our load to determine if we had enough capacity for some additional load and we found both banks loaded up to some extent but not overloaded, and one bank had some capacity to spare for our proposed load. Both banks were quite well balanced on all phases, just small unbalance which need not be considered.

However, on the primary, the current per leg was 50, 50 and 40 amps. Here we find one leg quite out of balance with the other two, if we figure how far we are out of balance in percent we are a long way from the other two legs. I repeat the unbalance on the secondary of either bank of transformers was not enough to consider, let alone enough to measure up to the percentage of unbalance we find on the primary. Our secondary voltages on both banks are good. Our lighting is primarily fluorescent but is taken from dry transformers within the plant from 3-phase banks which operate at 208Y/120 volts.

Why do we find this unbalance on our primary?

I would also appreciate the titles of a good text book on transformers which would answer questions of the nature just discussed, and also a book on transformers for determining the correct capacity of transformers to use for a certain load; for example, a power load.—G.R.G.

QUESTION B42—How does a saturable core reactor for dimming lights operate.

Recently I hooked up one and learned that the reactor contained both ac and dc windings. The ac windings were in series with the line to the lights and the dc windings were connected to a small rheostat which regulates the light output on the ac lamps.—J.K.

PLEASE SEND IN YOUR ANSWERS BY DECEMBER 15

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Now available under the I-T-E label are the new EQ-225 circuit breaker, new EQ-Loadcenter with 150A or 200A main breaker, and enclosed EQ-225 breakers . . (NEMA Type 1, 1B and 3) . . in ratings of 125, 150, 200 or 225 amperes. These new modern, compact devices provide positive protection against overload or short circuit conditions. The EQ-225 employs Quick-make, Quick-break, Trip-free mechanism action with common trip (not companion trip). A fault to ground automatically opens both poles of the breaker! Overcurrent protection combines the time proven thermal magnetic principle for positive protection against overload or fault conditions. For additional information, contact your nearest I-T-E District Office, or your local I-T-E Authorized Distributor.

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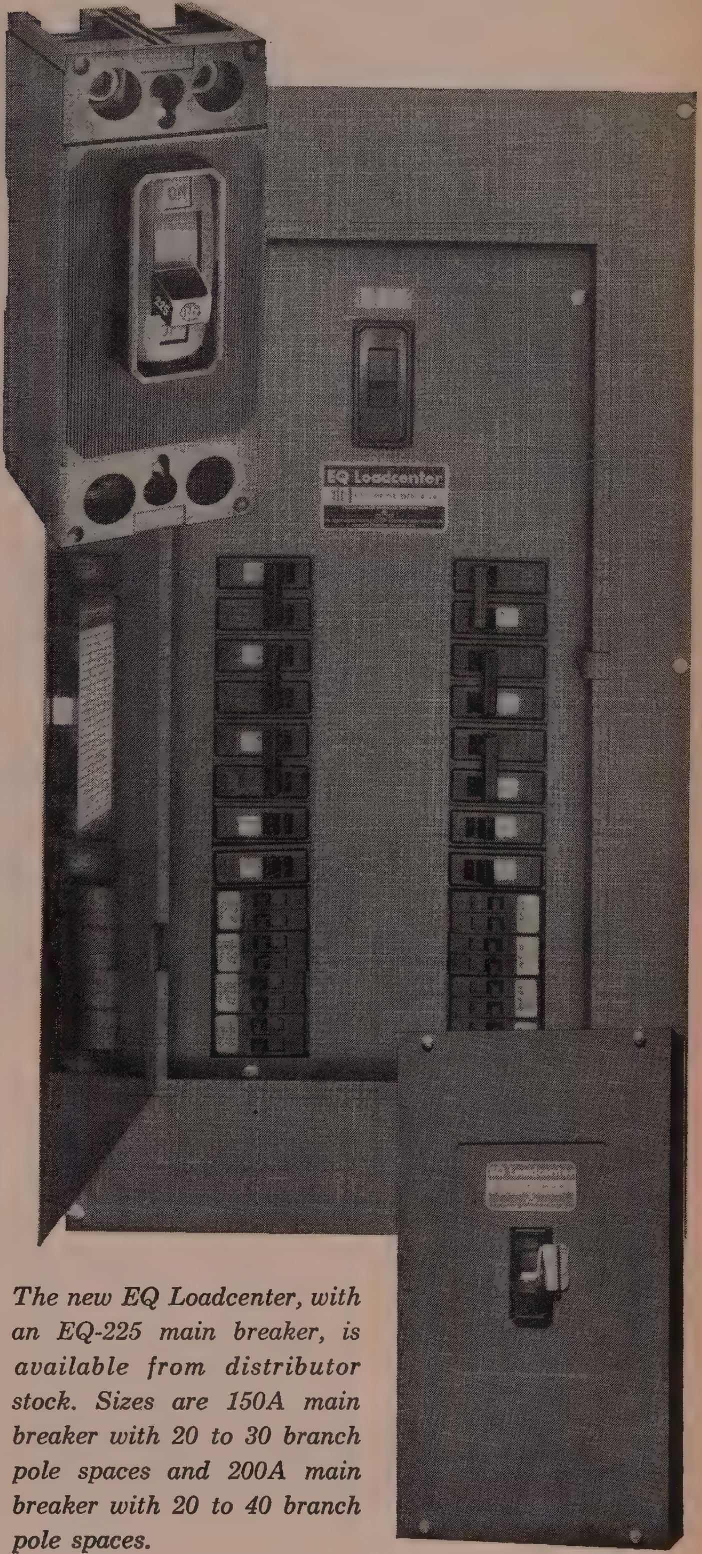
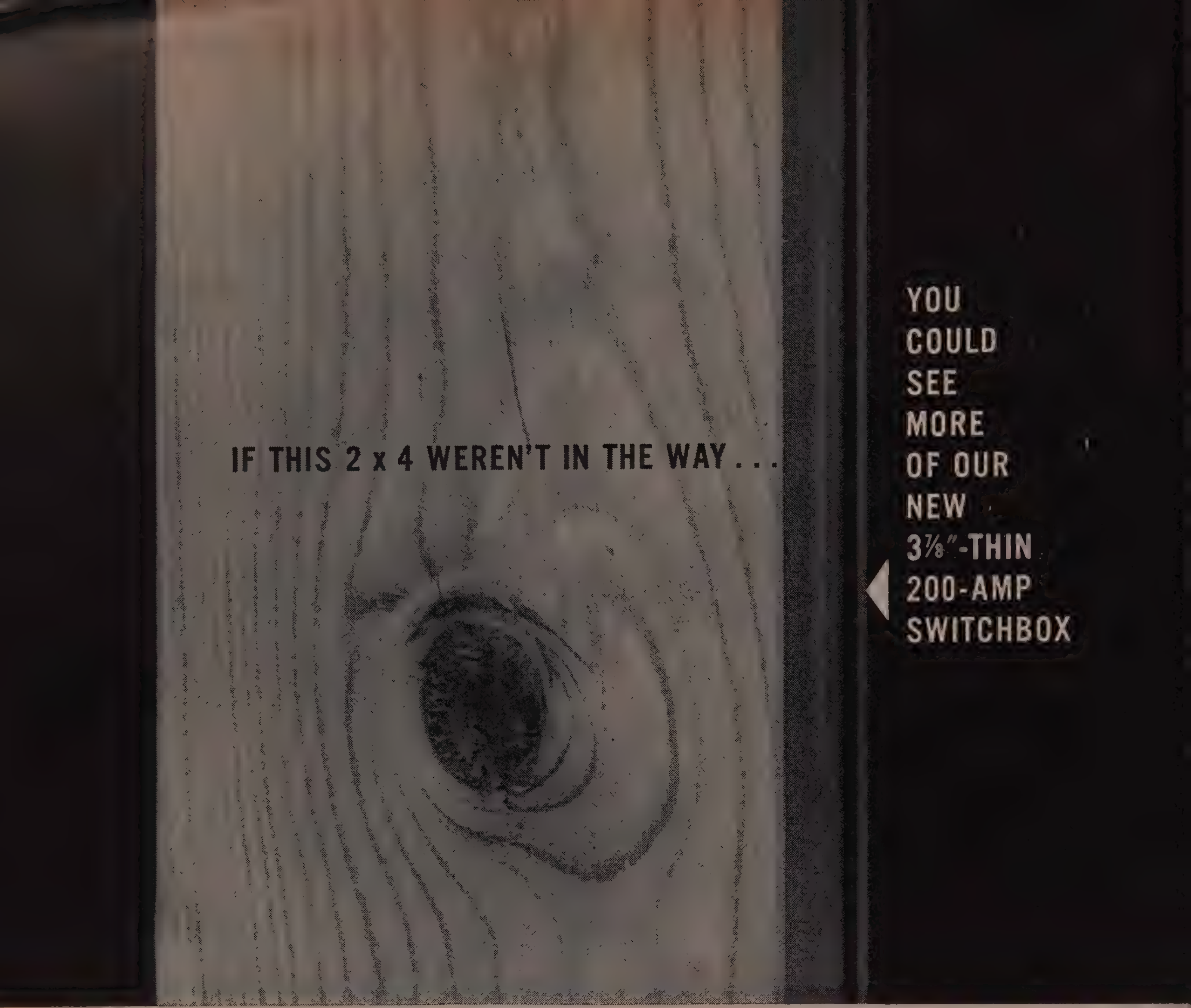


The new EQ Loadcenter, with an EQ-225 main breaker, is available from distributor stock. Sizes are 150A main breaker with 20 to 30 branch pole spaces and 200A main breaker with 20 to 40 branch pole spaces.

for the Contractor who is Proud of his work

I-T-E CIRCUIT BREAKER COMPANY


IF THIS 2 x 4 WEREN'T IN THE WAY . . .
YOU COULD SEE MORE OF OUR NEW 3⅞″-THIN 200-AMP SWITCHBOX

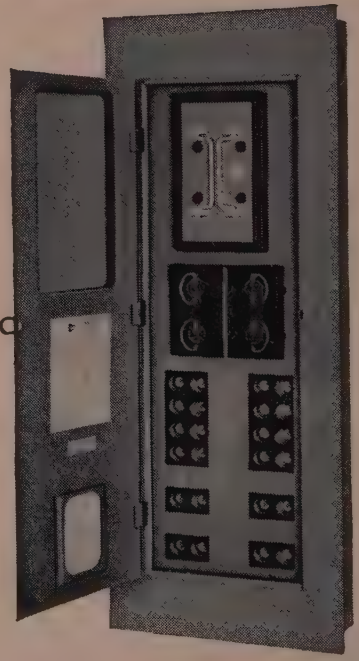
So slim that it mounts flush — even in dry wall construction.

And no features are sacrificed to achieve the new super-slim Clark-American 200-amp switchbox. You get plenty of knockouts, plenty of wiring space, AL/CU line lugs, positive bolt-in circuits, non-interchangeable branch pullouts h.p. rated for motor appliances, and up to 32 circuits by use of add-on feature.

This is modern Clark design, for modern construction of modern all-electric homes — models for indoor or outdoor installation.

Compare all makes with Clark when you select your line of electrical equipment for homes, commerce or industry. Compare for quality construction, ease of installation and eye-pleasing appearance.

And, compare price. Clark-American equipment costs no more.



Less bulk, less weight, more features. Clark-American's new 200-amp switchbox is dry wall thin. Branch circuit pullouts don't protrude. Be sure to use it in finished utility rooms of electrically heated homes—no other switchbox does the job so well.

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ELECTRIC SWITCH DIVISION

THE CLARK CONTROLLER COMPANY
Cleveland 10, Ohio

Code Forum

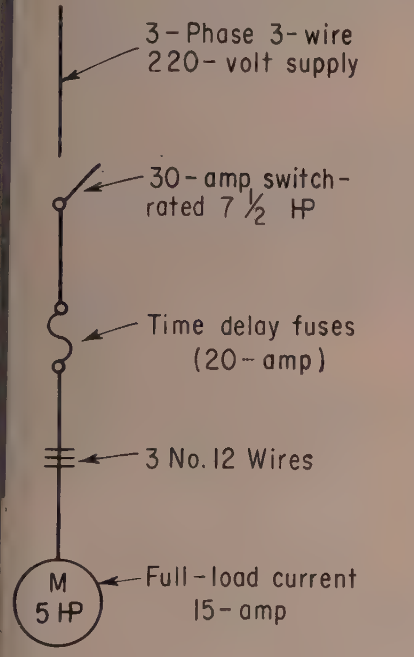
Answered by:

J. C. HEWITT, *Chief Electrical Inspector, Department of Labor and Industries, State of Washington, Olympia, Wash.*
B. Z. SEGALL, *Consulting Electrical Engineer, New Orleans, La.*
R. E. WARD, *Chief Electrical Inspector, Insurance Department, State of Tennessee, Nashville, Tenn.*

READERS are invited to submit questions regarding the National Electrical Code and its practical application to this Department. Questions are answered by the consulting editor whose initials appear at the end of each item. The views and opinions expressed are, in each instance, those of the individual consultant replying and are not necessarily those of his employers, of this publication or of a Code-making committee or panel on which he may serve in an official capacity.

vercurrent Protection
r Motors

Is it possible to use time-delay fuses, sized at 125%
the motor nameplate rating, to
ve as both branch-circuit protec-
n and motor-running protection?



example is shown in an accom-
nying drawing.—J.K.S.

For most applications, the answer to your question
ould be "yes" because Section 430-
permits a single overcurrent
vice to serve as both motor-
anch-circuit protection and motor-
nning protection if the size is
nall enough to qualify as the mo-
r-running protection called for in
ction 430-32. This latter section
nerally specifies that the running
otection shall not exceed 125% of
e motor full-load current. In your
ample, the motor is 15 amps, and
is value multiplied by 125%
ould equal 18.75 amps. However,
nce the protective device is a fuse,
d as such is non-adjustable, col-
nn 2 of Table 430-146 would rec-
nize the 20-amp fuse as the running protection for a motor rated at 15 amps.

For the motor-branch-circuit protection, the exception in Section 430-56 permits the use of smaller fuseholders where the designated fuses incorporate time-delay features appropriate for the starting characteristics of the motor. Since you do not indicate the starting characteristics or operation frequency of the 5-hp motor, you should approach this phase of the problem with caution. If conditions are such that the 20-amp time-delay fuses will start the motor the required cycles during normal applications, you will have no problem, and the installation described by you will comply with the code. On the other hand, some abnormal installations may require larger fuses to facilitate motor starting, and if the sizes exceed the maximum rating permitted for running protection, the fuses could not be used to serve a "dual" function. However, abnormal applications constitute a small percentage of all cases, and typical examples would be: where fuses are located in high-ambient-temperature areas; where the motor will be started frequently or reversed quickly; where the motor is direct connected or chain drive to machines that cannot be brought up to full speed quickly (such as some large fans, centrifugal machines, or machines with large fly wheels). Other than these few possible exceptions, the smaller time-delay fuses provide better protection for branch-circuit conductors and permit smaller fused switches. —J.C.H.

Comparing Definitions

Q. *Mention is made in the code in several places of weatherproof, raintight, watertight, and at least in one place of concrete tight.*

Is there a difference between raintight, watertight and weatherproof equipment?—W. F. H.

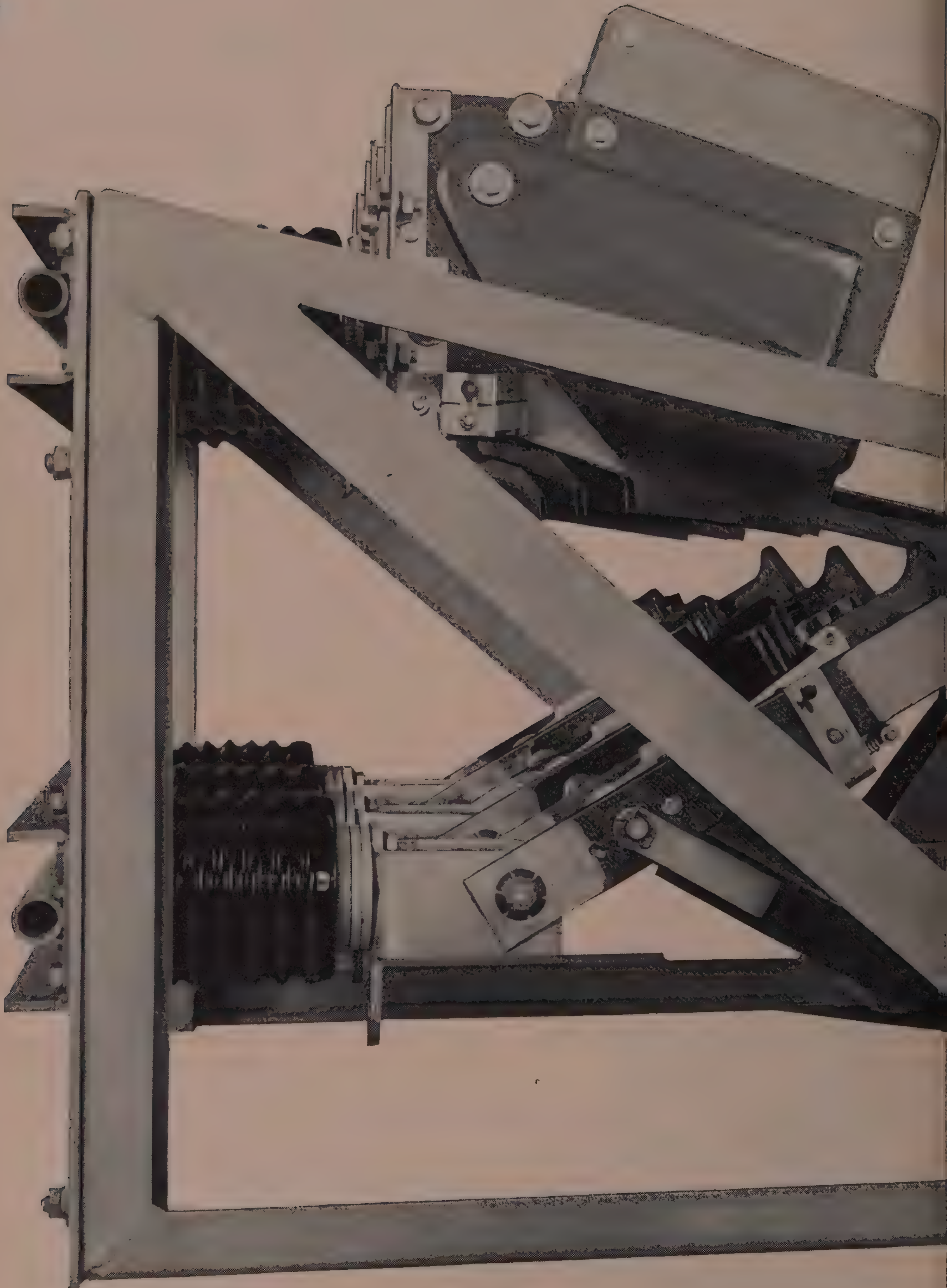
A. Under "Definitions" in Article 100, weatherproof, as applied to electrical equipment, means so constructed or protected that exposure to the weather will not interfere with successful operation. In the Advance Reports of the 1962 Code there is a fine print note, which reads: "Raintight or watertight equipment may fulfill the requirements for weatherproof; however, weather conditions vary and consideration should be given to conditions resulting from snow, ice, dust or temperature extremes." The definition for raintight as pertaining to electrical equipment is that it is so constructed or protected that exposure to a beating rain will not result in the entrance of water. Watertight is equipment so constructed that moisture will not enter the enclosing case. Concretetight pertains to fittings that would be required to meet certain standards or tests of recognized testing agencies or laboratories before such fittings could be marked as concretetight.

Therefore, from the fine print note as recorded in the Advance Reports and the definitions in the 1962 code, there is a possible difference, between raintight, watertight and weatherproof because the fine print note mentions conditions other than those caused by water. —R. E. W.

Supply Conductors To Fixtures

Q. *I recently had an installation using UL listed pan-type lighting fixtures. Printed in plain view inside the fixtures was the statement concerning size bulbs to use and also to use supply wire suitable for 75°C. This installation was in a residence, with the method of wiring being non-metallic sheathed cable. I was unable to secure such cable rated at the 75°C. The fixtures in question had a batt*

Accent on VALUE



Low-cost Protection

General Electric stationary switch and fuse equipment is designed to fully meet your light-duty switching and fault-current protection needs. G-E switch and fuse equipment gives you quality where it counts.

Non-expendable arc chutes are made of the same high quality phospho-asbestos compound as the chutes in G-E magne blast power circuit breakers. Manufactured to extremely fine tolerances, these chutes have high performance characteristics and long life.

Current-limiting fuses are on the source side of the load-break switch to provide better protection. Fuses limit short-circuit currents to values far below harmful levels in ½ cycle or less to prevent damage to protected equipment. And interruption is clean—since there's no discharge when fuses interrupt and no dangerous gas build-up.

Stored energy switching provides consistent, positive make and break to lengthen contact life, reduce maintenance, and provide greater safety.

It makes good sense to install reliable, low-cost switch and fuse equipment when the benefits of metal-clad switchgear's higher ratings, repetitive interrupting capabilities, sensitivity to single-phasing and ground-fault currents, are not required.

Examine your system. If fused overcurrent protection is justified, and switching requirements do not exceed 13.8 kv, look into the economies of General Electric stationary switch and fuse equipment.

In addition to stationary switch and fuse or rollout switch and fuse, G.E. offers a full range of voltages and capacities in the metal-clad switchgear line.

For more information, talk to your General Electric sales engineer, or write for bulletin GEA-7718. Sect. 514–01, General Electric, Schenectady 5, N.Y.

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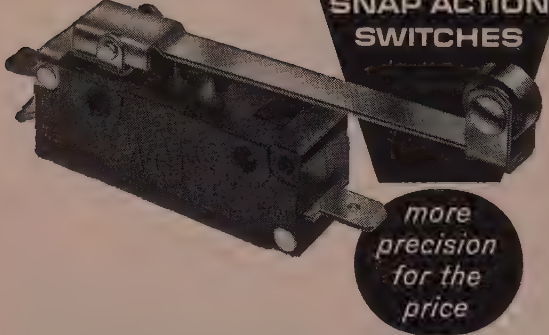

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more precision for the price

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9 standard actuator variations in SPDT; SPST normally open; and SPST normally closed models. Wide range of movements and operating forces available. Rated at 15 amps. 125-250 V. A.C., ¾ H.P., 125 V. A.C.; 1½ H.P. 250 V. A.C. Underwriters' Laboratories Listed; C.S.A. approved.

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How To Bend Conduit

of insulation glued to the upper side of the pan of each fixture that could be called a barrier between outlet box and fixture, which would prevent passage of heat from one to the other.

Does the code recognize any method of installation other than the wire suitable for the temperature marked on such fixture or device?—C. G.

A. Your question is one that is giving much concern to many electrical contractors, inspectors and home owners. To my knowledge the code does not recognize any other method of wiring fixtures or other devices and equipment unless the conductors used are suitable for the temperature as marked in such fixtures or devices. This marking is found in listed equipment where the requirement is for conductors rated **above** 60°C. Although the code would not recognize the placing of extra insulation between the outlet box and the fixture, many inspectors have accepted this method because they considered that by the placing of extra insulation, the temperature would not exceed the rating of the conductors in the outlet box located above the fixture.

One of our local electrical distributors made the statement to me that he had been informed that 75°C cable was available but that he had been unable to secure any from his supplier. He certainly felt that they should not stock fixtures requiring conductors such as you mention unless they could also supply the conductors as required for such fixtures or other devices and equipment.—R. E. W.

Rural Meter Poles

Q. *When the meter enclosure and main disconnect switch are located on a pole on private property, is it mandatory to comply with the six-disconnect rule for each building thus served from the master service (the residence, barn, pump house, farm shop, etc.)?—P.M.C.*

A. The main disconnect switch on the meter pole is more appropriately termed a master switch, which will disconnect the supply of *all* buildings served by this switch. I point this out because Section 230-76 is the key code rule involved here. This Section concerns the disconnecting mean

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The Volkswagen Truck has a road clearance of 9½ inches. (Most other trucks only clear 7.)

That extra 2½ inches means your bumpers and tail pipes won't scrape bottom if you drive down a steep driveway or off a high curb.

It means big 8-inch rocks or ruts or tree stumps won't tear up our bottom if you have to use the VW off the road.

And our bottom won't drag through snow or slush or mud or sand. (You won't get stuck too easily, either. The VW engine is in the rear. For extra traction.)

In heavy rains you can go through deeper water than others. (Some VWs are even driven across shallow rivers.)

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where more than one building, under single management, is concerned; and reads in part: "In a property comprising more than one building under single management, the conductors supplying *each* building served shall be provided with a readily accessible means, within or adjacent to the building, of disconnecting all ungrounded conductors from the source of supply." As a result, *each* building must have a disconnecting means, which, in my opinion, could consist of one to six switches as in the case of an individual service to an individual building. In other words, each set of conductors supplying a building must have an independent means of disconnect for that building. And I base this opinion on Official Interpretation No. 63, issued in 1939.

"QUESTION—Is it intended in Section 2306 to make possible *independent* disconnecting of each building when several buildings are supplied from a master service?

"FINDING—Yes."

Section 2306 of the 1937 Code is substantially the same as Section 230-76 of the 1962 edition, so the same intent should apply. While you do not mention whether the meter-pole master switch is fused or unfused, this factor would have no bearing on Section 230-76. Besides the disconnecting means, if the supply conductors to each building from the meter pole are overhead, they are considered as service-drop conductors whether the master pole switch is fused or unfused—according to the fine print note in Section 230-24, which states: "Conductors to a building from a pole on which a meter or service switch is installed shall be considered as a service drop and installed accordingly." Therefore, any such overhead conductors must be sized and installed according to all rules applicable to service drops in Article 230. In addition, the neutral conductor must be grounded at each building where required by Section 250-24. As to the master switch on the meter pole, you should check with the local inspection authority because of varying requirements on this subject in different parts of the country. Some areas require a CB or fused master switch, while others permit a nonfused disconnect or no disconnect at all on the meter pole. For my own part, I believe safety is greatly enhanced by installing a main CB or fused switch on the pole. And in any event, each building supplied from the master service must have its own disconnecting means, as required in Section 230-76—J.C.H.

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Have tremendous holding power; limited only by the strength of the material in which they are set, or by the tensile strength of screw used.

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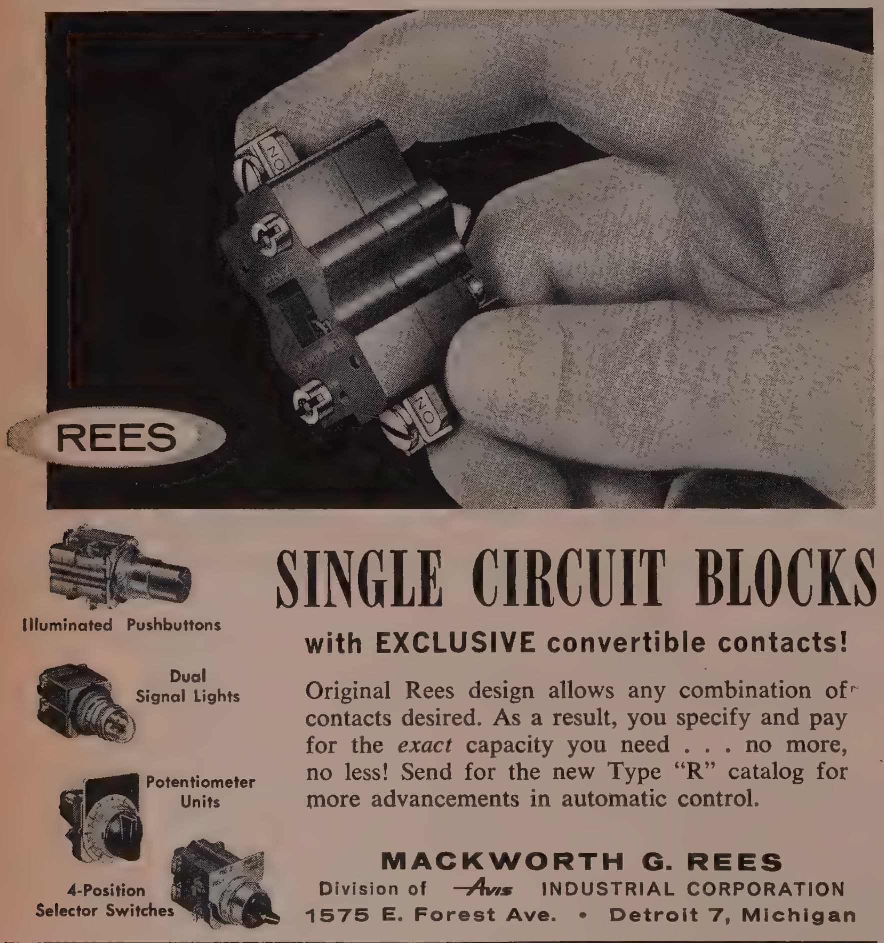

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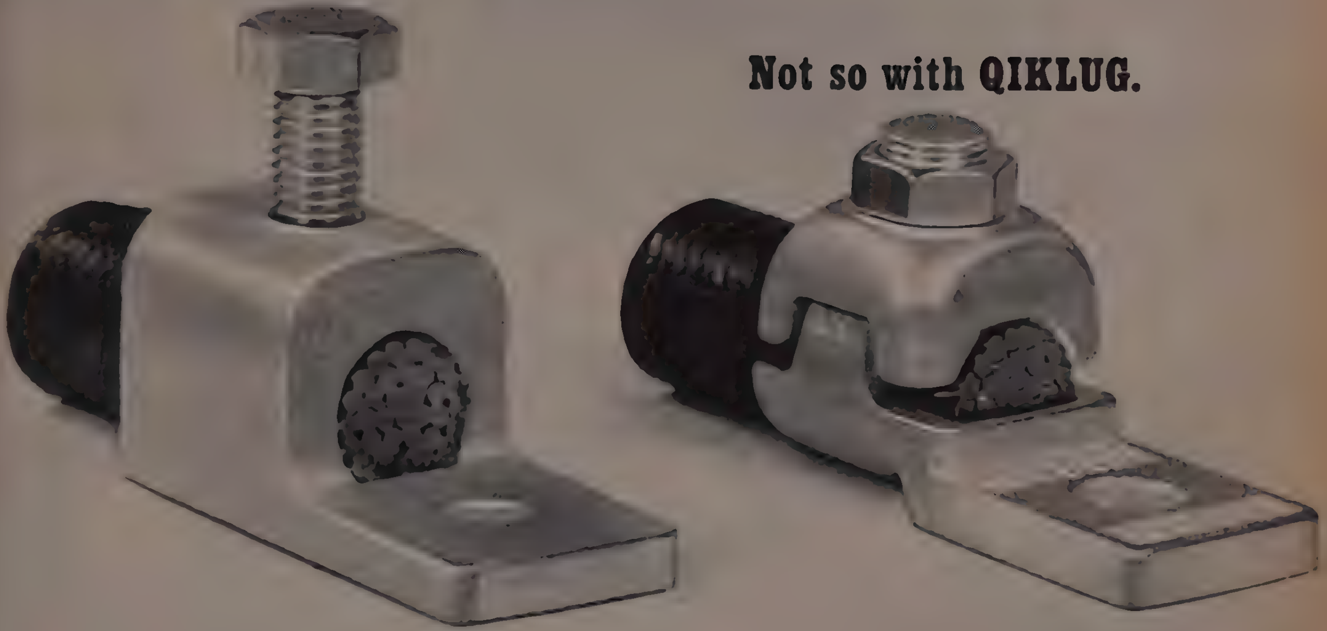

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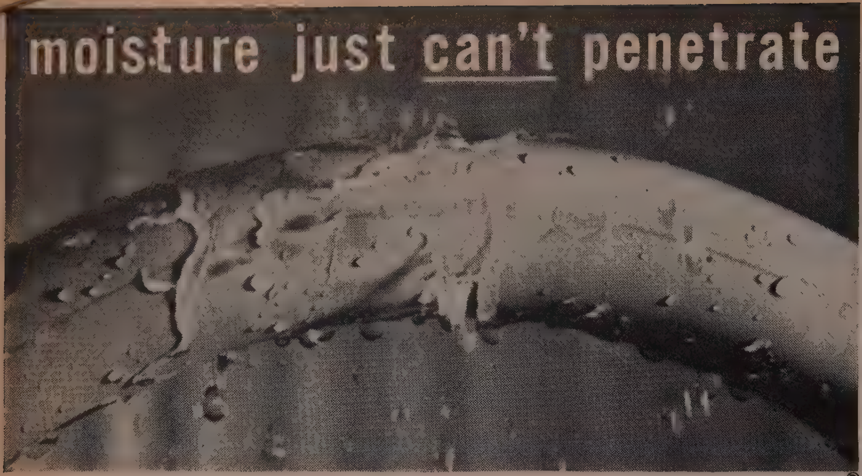

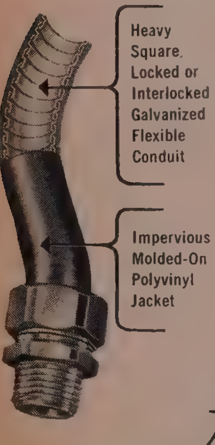
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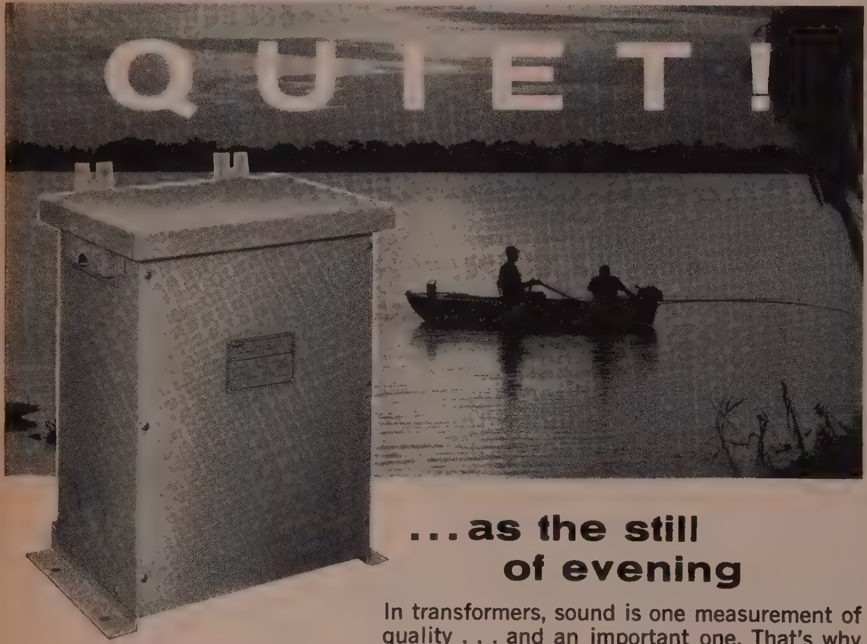

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Grounding for Swimming Pools

Q. *Our company is now preparing plans and specifications for a municipal swimming pool. Can metallic raceways be used as the grounding conductor?—H. H. B.*

A. No. You state that you are now preparing plans. At present the 1962 Code is available for distribution. It was published during the month of September, 1962. The 1962 Code does require under Section 210-9, "Branch circuits supplying fixed, movable or portable equipment and lighting in or on swimming pools shall include a grounding conductor for the purpose of grounding the non-current-carrying metal parts of such equipment or lighting. The metal armor of armored cable or a metallic raceway is not acceptable as the required grounding conductor in this application."

There is also a fine print note which refers to Article 680. Article 680 of the 1962 Code concerns swimming pools and is a new article, and I would certainly suggest that a study be made of Article 680 before plans and specifications are released for bids.—R.E.W.

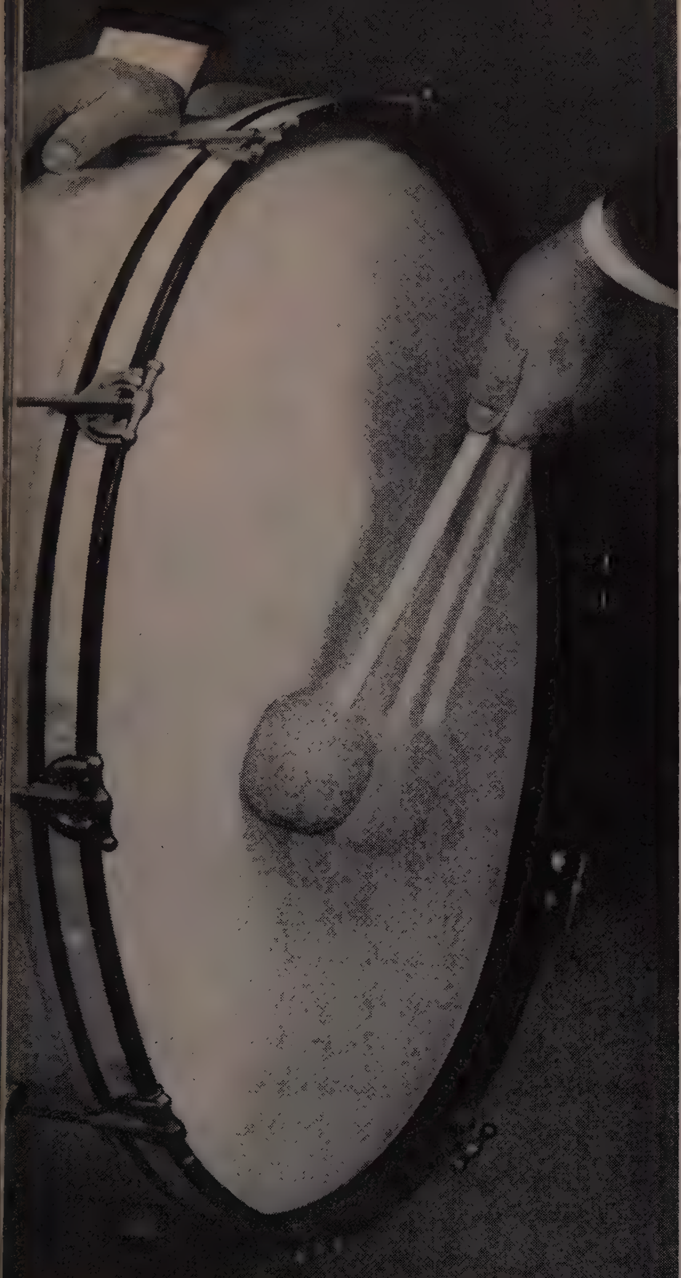
Installation of Wall-Insert Heaters

Q. *I have been informed that the next edition of the code will require the mounting of wall-insert electric heaters 24 in. above the floor. The fact is I have seen such marking on a heater.*

Will it be a requirement that all heaters be mounted 24 in. from the floor?—M.R.L.

A. No. The National Electrical Code does not specify the height or distance from a wall that a heater be mounted. However, Section 422-6 reads: "Protection of Combustible Material. Each electrically heated appliance that is obviously intended by size, weight and service to be located in a fixed position shall be so placed as to provide ample protection between the appliance and adjacent combustible material."

Underwriters' Laboratories, in their standard, UL 573—Electric Space-Heating Equipment, dated March, 1961, states in Paragraph 251: "A permanently connected, wall-mounted air heater, which is



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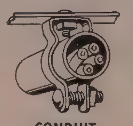

CONDUIT HANGER

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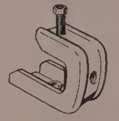
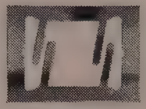
SNAP-STRAP FOR THINWALL CONDUIT



BEAM CLAMP



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Each fitting is carefully engineered to assure you of top quality and years of trouble-free use. Compare Blackhawk with other fittings — you can actually see the difference.

At Blackhawk, the smallest fitting is designed to specifications as exacting as those of larger, more complex electrical equipment.

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See your truck dealer or write for name of local distributor.

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not suitable for installation close to the floor, shall be plainly marked 'Do not install so that bottom of heater is less than 2 ft above floor or with an equivalent statement. Underwriters' Laboratories, in determining whether or not a heater is suitable for installation close to the floor, has certain procedures called their furniture tests. Such tests are outlined in the previously mentioned UL standard. A heater that passes their furniture tests is not required to be marked for installation 25 in. above the floor and can be installed closer than 24 in. from the floor. Information from UL is that several manufacturers offer heaters that have passed these tests and may be mounted less than 2 ft above the floor. This is a fire prevention measure, and requires the cooperation of all concerned as the record will show fires have been caused by placing furniture or other objects directly in front of and against heaters. Such furniture or objects are usually placed in front of the heaters during the season when heaters are not used and when temperature drops and reaches a point where the thermostat on the heater calls for heat, a heater would be energized and by being blocked in some cases, a fire could occur.

As a personal point of view, I am quite sure that many property owners will not want wall-insert heaters mounted with the bottom 24 in. from the floor. As a result all heater manufacturers should consider the development of heaters that will meet the UL furniture tests.—R.E.W.

Type THWN Conductors

Q. *I have heard that the 1962 NEC will recognize a new Type THWN conductor, which is purported to have a smaller over-all cross-sectional area than respective sizes of Type TW conductors. If this is true how many No. 12 THWN conductors could I pull in existing concealed ½-in., ¾-in., and 1-in. conduits that will be required to be rewired in the near future? —B.R.*

A. Your understanding of the recognition given to Type THWN conductors in the 1962 NEC is correct. Revised Table 5 of Chapter 9 includes the dimensions of this new type of conductor (Columns 6 and 7). As noted in this table, Type THWN wire is recog-

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nized in sizes of No. 14 to 500 MCM, and it is obvious that the cross-sectional area of this wire is somewhat smaller than that shown in column 5 for Type TW in corresponding sizes. The new THWN wire has a moisture and heat-resistant thermoplastic insulation with a thin but durable nylon jacket. By the use of the nylon jacket, a smaller diameter of thermoplastic insulation is possible.

For rewiring an existing concealed conduit with three or more conductors, the maximum conductor fill is 50% of the cross-sectional area of the conduit. The 50% dimensions of ½-in., ¾-in., and 1-in. conduits are 0.15, 0.27, and 0.43 sq. in. respectively. From Table 5, the cross-sectional area of a No. 12 THWN conductor is 0.0117 sq. in. Therefore, 12 No. 12 THWN conductors would be permitted in the ½-in. conduit (0.15/0.0117); 23 in the ¾-in. conduit (0.27/0.0117); and 36 in the 1-in. conduit (0.43/0.0117). As a matter of comparison, No. 12 TW conductors would be limited to eight in the ½-in. conduit, 15 in the ¾-in. conductors, and 25 in the 1-in. conduit. Obviously, the new THWN conductors will be extremely beneficial in rewiring existing conduits for increased loads. —J.C.H.

Grounding Panelboards

Q. *We have a 20-unit apartment building with the main service equipment located in the basement. Adjacent to the main service we have a disconnecting means with overcurrent protection for each apartment. In each apartment there is a 10-circuit panel. The feeder from the overcurrent device located in the basement to each panel is non-metallic. This non-metallic cable contains three insulated conductors — two ungrounded and one grounded. Our position is that this cable should contain a fourth conductor for grounding purposes. The electrical contractor maintains that proper grounding can be accomplished by grounding the equipment to the cold water pipe in each apartment.*

Which method meets code requirements?—A.J.H.

A. Under Paragraph 250-57(b) three permissible methods of grounding fixed equipment are given, which are as follows:

"(1) By a grounding conductor run with circuit conductors; this conductor may be uninsulated, but where it is provided with an individual covering, the covering shall be finished to show a green color.

"(2) By a separate grounding conductor installed the same as a grounding conductor for conduit and the like;

"(3) By special permission, other means for grounding fixed equipment may be used."

Certainly the code recognizes the grounding conductor when a part of the cable assembly, and in my opinion would be preferable over either of the other permissible methods. The authority enforcing the code, if in their opinion effective grounding was provided by the connection to the cold water pipe, could accept such under the special permission rule outlined in No. 3. Many inspection authorities would not accept this method due to the fact that ground continuity would not be maintained over the electrical system. Such ground continuity would be dependent upon the water piping system, and certainly in repair and replacement of plumbing equipment, piping, etc., there is the possibility of disconnecting the grounding conductor from the piping system.—R.E.W.

Definitions for Appliances

Q. *Under Article* 100 *"Definitions", we find three definitions for appliances that will be in the* 1962 *Code; the three definitions being fixed, portable, and stationary.*

Does the method of wiring (cord-connected or permanent) determine or govern the classification of the three types of appliances?—M.L.Y.

A. In the open forum or discussion period at the NFPA meeting held in Philadelphia, on May 22, 1962, Kent P. Stiner, Chairman of Panel No. 1, which deals with Articles 100 and 110, gave as examples the following: fixed appliance, air conditioner; portable appliance, toaster; stationary appliance, range.

From the above examples certainly the method of wiring would not govern the classification of the appliance as we have window air conditioners that are cord connected, and ranges and toasters that are cord connected.

Therefore, in answer to your question, the method of wiring would not govern the classification of an appliance.—R.E.W.

30-Amp Sign Circuits

Q. *In reviewing the revisio
to be included in the 19
NEC, I notice that 30-amp bran
circuits may supply electric d
charge lighting transformers us
for electric sign and outline lig
ing. Would signs with fluoresce
ballasts fall in this category? A
does this rule apply to signs
side as well as outside of bui
ings?—D.K.*

A. Obviously you are referri
to Section 600-6 of the 19
NEC, which has been revised
read as follows: "Load of Bran
Circuit. Circuits shall be so a
ranged that the load imposed
outlets, lamps, and transforme
connected to them, shall in no ca
exceed the rating of the bran
circuit.

"Circuits which supply lam
ballasts, and transformers or co
binations may be rated not to e
ceed 20 amps.

"Circuits containing electric di
charge lighting *transformers* e
clusively shall not be rated in e
cess of 30 amps."

In quoting this new code revisi
I have stressed the words "ballast
and "transformers," because the
is a fundamental difference in su
units as far as code application f
signs is concerned. In the case
a sign containing fluorescent lamp
the auxiliary equipment consis
of a *ballast* with attached leads.

Neon signs contain "neon" tran
formers, which the code refers
as an "electric discharge lighti
transformer." The primary a
secondary leads are generally ma
to terminal screws provided on th
transformers. And it is my opinio
that only these types of transform
ers could be connected to a 30-am
sign circuit.

Circuits to which "ballasts" a
connected would be limited to 2
amps, in my opinion. Therefor
this is my answer to your fir
question.

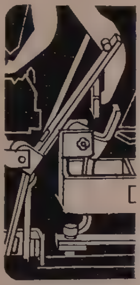
As to your second question,
feel that Section 600-6 applies
signs installed either inside or ou
side of buildings. However, por
able neon window or similar int
rior signs, equipped with a co
and receptacle cap, should be i
stalled on branch circuits rated n
to exceed 20 amps.

Since most electric signs are us
"for a long period of time"—
phrased in Paragraph 210-23 (
—the connected load on each bran
circuit would be limited to 80
of the circuit rating.—J.C.H.

Why buy circuit protection only?

Westinghouse circuit breaker accessories permit modification for unlimited functions

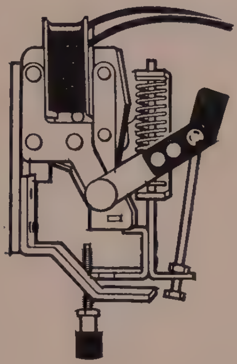
1



ALARM SWITCH

When the breaker is tripped by overload or short circuit, the alarm switch closes to energize an indicating light or sound an alarm. Switches that open on tripping can also be supplied. They do not function on manual operation.

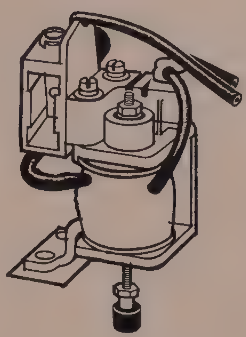
2



UNDERVOLTAGE TRIP

A solenoid plunger actuates the trip mechanism to automatically trip the breaker when the line voltage drops below 40 to 60 percent of normal. Breaker cannot be reset until voltage returns to 80% of normal.

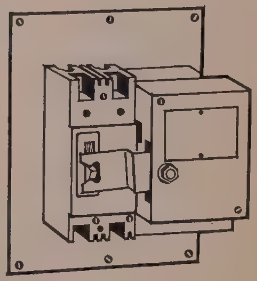
3



SHUNT TRIP

The shunt trip is used for tripping the breaker from a remote point by a pushbutton or other device. Because the shunt trip coil does not have a continuous rating, a cut-off switch can be included to break the energizing current when the breaker opens.

4



MOTOR OPERATED BREAKERS

These externally mounted motor operators provide complete remote control of the breaker. If automatic resetting is desired, an auxiliary switch can be mounted inside the breaker to operate the motor and return the breaker handle to the open (reset) position.

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Westinghouse circuit breakers give you superior circuit protection—plus versatility limited only by your imagination. Before you buy *any* competitive units, be sure to investigate how Westinghouse units can be modified to give you flexibility of operation and efficiency. The four features illustrated here are only a sample of the Westinghouse equipment available to meet your special requirements. Ask your Westinghouse representative for information about the available accessories. Or write direct to Westinghouse Electric Corporation, Standard Control Division, Beaver, Pa. *You can be sure . . . if it's Westinghouse.*

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In the News

NECA Urges "Competitive Competence"

Market development, selling techniques and electrical code instruction were program highlights of the 1962 convention of the National Electrical Contractors Association in Minneapolis, Minn., October 10-13.

CHARLES P. BOBE, Beach Electric Co., St. Louis, Mo., received the James H. McGraw Award Contractors Medal from Harold A. Webster, president of NECA.

Emphasis was strong on continued development of the managerial and technical aspects of electrical contracting at the 1962 convention of National Electrical Contractors Association. A four-day program of general membership sessions in the Minneapolis Auditorium covered a wide range of subjects. In addition to many addresses by nationally notable personalities in the electrical industry, several dramatic skits were presented to portray training courses and other programs of industry cooperation. The lively and colorful program of timely topics was enjoyed by a large attendance of electrical contractors, manufacturers and guests.

An integral part of this 1962 convention was the Eighth National Electrical Exposition in the Auditorium's exhibit halls. Booths and demonstrations were manned by many electrical manufacturers. From busways to batteries, fuses to fishlines, breakers to benders, switchgear to sockets, concrete saws to price services—a wide range of electrical apparatus, supplies and services were represented at this exposition.

In keynoting the opening business session, President Harold A. Webster referred to competition in the contracting field, stating that this challenge was fostering a quality of competence which benefited not only independent contractors, but customers, industry and national interests as well.

Mr. Webster maintained that contractors should seek histories of competitive performances and repeat customers; good reputations within the industry among workers, competitors, suppliers and subcontractors; sound organizational structures; personnel training programs; accurate cost distribution accounting, including field cost systems; modern tools and equipment; good, detailed estimating systems; universally accepted accounting systems; constant growth patterns; adequate insurance coverage; engineering backgrounds in their specialties; understanding of free private competitive enterprise, and stated and practiced business philosophies. In conclusion he urged delegates to place higher values on their services, asking "why is it that so many have the nerve to take the high risks of complex jobs but lack the fortitude to demand reasonable profits?"

The first session also included reports by NECA's Executive Vice President Paul M. Geary, and Secretary-Treasurer Clint J. Harder.

In this summary, Geary cited the Association's need to be more fully representative in all fields, stating that 150 wage areas in the country still lack NECA chapter coverage, and that Association membership of only 4300 contractors is considerably short of the known potential. He maintained that "many small businessmen become so frustrated by legal limitations placed upon activities of their industry's trade association that they neglect to participate or benefit as they could from lawful activities which are being conducted, and other activities which could be conducted with their cooperation."

Harder's report reviewed membership, chapter and financial status; then paid tribute to Veteran Members elected by the Executive Committee during the past year: R. W. Mitchell of Buffalo, N. Y.; John Ecton of Vinita, Okla. and C. R. Wright of Knoxville, Tenn.

Awards

"In recognition of his dedication to providing safe electrical installations in the public interest and his substantial personal contribution to the entire electrical industry in the field of technical and training services," Frank G. Camus, president, C&C Electric Co., Shreveport, La., was honored with the annual Coggeshall Award.

Also recognized for his "significant part in the industry's apprenticeship and training program," while serving as co-chairman of the National Joint Apprenticeship and Training Committee, was Milton

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End Costly Mismatches with famous

"SIZE-MARKED" MINERALLAC® Jiffy®-Clips

Minerallac—the originator of the famous and widely imitated "Jiffy-Clip"—is the only company to make FOUR complete lines of these clips. The most complete choice on the market today. Fits 1/8" copper tubing and up to 6" iron pipe.

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Made of heavier material. Has exclusive inverted rib, that provides more strength at the bend of clip . . . and, of course, adds the benefits of famous "Snap-On" feature. Heavy-duty clips available in aluminum.

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Each Minerallac fitting is "SIZE-MARKED". All are clearly and individually stamped with its exact size for immediate identification and quick and easy handling. Ends time-consuming guesswork and costly mismatches in the stock room and on the job.

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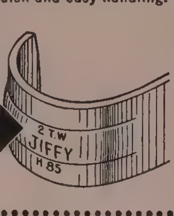

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Staub, president, Gustav Hirsch Organization, Inc., Columbus, Ohio. Mr. Staub's leadership was acknowledged by presentation to him of the Louis K. Comstock Award.

Charles P. Bobe, vice president, Beach Electric Co., St. Louis, Mo., likewise was honored at this NECA convention for "personal initiative and leadership in developing management and technical training programs for the broad benefit of the electrical contracting industry." Bobe, who received the Contractors Medal and Purse given under the James H. McGraw Award for Electrical Men, was recommended for that honor by a panel of judges consisting of R. J. Knoblock, Krause & Heil, Inc., Syracuse, N. Y.; R. G. Frame, Frame Electric Co., Pittsburgh, Pa.; E. E. Leasure, Jr., Monroe Electric Co., Chicago, Ill.; R. W. Osborn, Osborn Electric Co., St. Louis, Mo., and H. A. Webster, T. Frederick Jackson, Inc., New York, N. Y.

Integrated Venture

Of considerable interest was a panel discussion concerning a unique joint-venture organization, wherein a general contractor, electrical contractor, piping contractor and boiler specialist combined their organizational manpower, engineering abilities and financial resources to bid major construction services under a single prime contract. This venture for "Meeting Integrated Contractor Competition" was discussed by George M. Bard, president, and James E. Dow, executive vice president, Kelso-Burnett Electric Co., Chicago; George N. Martin, president, Bates & Rogers Construction Corp. (general contractor); Leslie A. McKane, sales manager, Power Div., Henry Pratt Co. (boiler erection), and Frank E. Barnes, manager, Power Div., William A. Pope Co. (piping).

"Partners in Progressive Enterprise" was the topic of a discussion by Allen S. King, president, Northern States Power Co., who maintained that, in the brief span of 80 years, "the electrical industry has progressed from a luxury of the rich to a necessity for the masses; the basis for our industrial might and the Genie responsible for our envious standard of living."

Representing the host Twin Cities at this first meeting were Allen A. Lindberg, president, Minnesota (St. Paul) Chapter, and Oscar Leppa, president, Minneapolis Chapter; both of whom made brief addresses of welcome.

Emphasis on Code

Technical and management co
petence was discussed at the co
vention's second business meetin
which was called to order by R.
Osborn, NECA vice president, D
trict 7 and chairman of the Asso
ation's Codes & Standards Com

In advocating nationwide co
training, Osborn mentioned tha
although the 1962 NEC had ju
come into being, action already w
being taken regarding furth
changes which would become effe
tive in 1965.

Osborn also stated that begi
ning next January, NECA men
bers would be conducting code co
ferences in all parts of the countr
and that members should recogni
these conferences as a responsib
ity to learn, as well as an opport
nity for improving NECA's publ
relations.

Osborn was followed on the pr
gram by E. E. Carlton, presiden
International Assn. of Electric
Inspectors, who stated that th
IAEI desired to (1) formulat
standards for safe installation an
use of electrical materials, device
and appliances, (2) promote un
form understanding and applicatio
of the NEC as well as adopted code
in various states, cities and othe
countries, (3) promote uniform ad
ministrative ordinances and inspe
tion methods, (4) collect and dis
seminate information relative t
the safe use of electricity, (5
represent electrical inspectors in a
matters encountered by the electri
cal industry, nationally and inter
nationally, (6) cooperate wit
other national and international o
ganizations in the further develop
ment of the electrical industry, an
(7) promote cooperation among in
spectors, inspection department
the electrical industry as a whol
and the public.

Echoing the theme of safety wa
Roy G. Benson, manager, Industri
Section, National Safety Counc
Chicago, who maintained that i
juries on construction projects on
were accepted as inevitable, a
though numerous surveys pro
that frequency and severity of acc
dents can be reduced drastical
when management and labor c
operate in recognizing and pra
ticing safe routines and condition

Labor Costs Studied

Another topic included on t
second business program co
cerned labor cost study metho
described and demonstrated

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Sticks instantly, because this new adhesive was specially formulated for use over a wide range of temperatures encountered by electricians.

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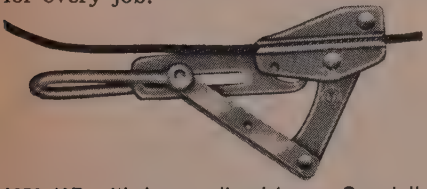
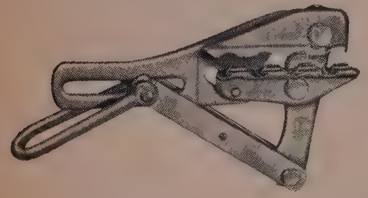
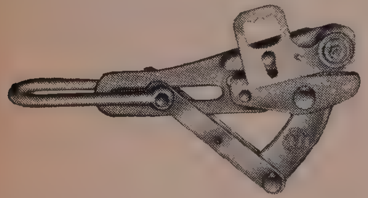
Write for the Klein Grip Selector to make sure you have the proper grip for every job.



1656-40B with bronze-lined jaws. Specially designed for bare A.C.S.R. aluminum and stranded copper cable.
Opening from .50 to .74 inch.

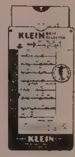


Machined jaws allow snaking insulated conductors, eliminating slippage and preventing conductor damage. Insulation does not have to be stripped from conductor.
1659-40—openings from .49 to .80 inch.



This hot line grip may be placed on wire with stick. Safety latch has three positions and closes automatically when stick is removed. Cannot fall off wire. Can be used for hot or dead work.
1628-5BH—openings from .198 to .522 inch.

FREE GRIP SELECTOR
To utility companies, the grip selector is available without charge. It shows the proper Klein grip for any type of wire and gives full information for servicing.



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Julius Pieper, Pieper Electric, Inc., Milwaukee; Bruno Barg, B. H. Barg Electric Co., Milwaukee; William Lemberg, Lemberg Electric Co., Inc., Milwaukee; Gene Kasal, Milwaukee NECA Chapter; Louis J. Jost, Bentley-Jost Electric Corp., Milwaukee; and Clarence A. Knoerr, Knoerr & Fisher, Inc., Milwaukee.

Frank Smith, electrical installation supervisor, and Thomas Hughes, industrial engineer for the Minneapolis Honeywell Regulator Co.

In this analysis it was indicated how random sampling could be evaluated to determine what proportions of a worker's time was productive, contributory or waste. Sampling requires a qualified observer, accuracy, practical objectives, sufficient random samples to obtain useful representation, systematic recording procedures and intelligent analysis, they claimed, while showing how prescribed methods of sampling could relate to activities on construction projects such as bending conduit or using power tools (productive), or reading prints or handling materials (contributory).

Bernard N. Voss, governor of NECA's Eastern Oklahoma (Tulsa) chapter, announced that a new course on Business Management would be available, beginning next February, covering such subjects as office functions and procedures, personnel and sales management, business operations, fundamentals of executive direction, financial aspects, records and accounting methods, bookkeeping and budgets, potential markets and promotions.

Designed for all sizes of contracting organizations, the course will include both indoctrination and review, Voss announced, adding that education courses such as this should make NECA contractors more competent, therefore more competitive.

Highlighting the second business session was a panel discussion concerning foreman training. Moderated by George E. Trinastich, president, Greater Kansas City Chap., this panel included W. Floyd Taylor, governor, N. J. Chapter; also Edward LaPointe and Richard Hunt, former training instructors for the Minnesota (St. Paul) Chapter.

Purpose of this course, collective panelists maintained, was to acquaint foremen with labor units, the use of modern tools and installation equipment, job construction methods, payroll and estimating procedures, material handling facilities, purchasing and requisition methods.

PERT Defined

As a conclusion for the second session, Brig. Gen. T. J. Hayes, asst. chief of engineers for NASA support, U. S. Army, emphasized the importance and value of modern management systems endorsed for military construction work. Time, cost and performance can be controlled by integrated planning, he stated, indicating that a system known as PERT (Program Evaluation and Review Technique) is far superior to any previous program method used to schedule critical paths of intercontinental ballistic missiles such as the Atlas, Titan and Minuteman.

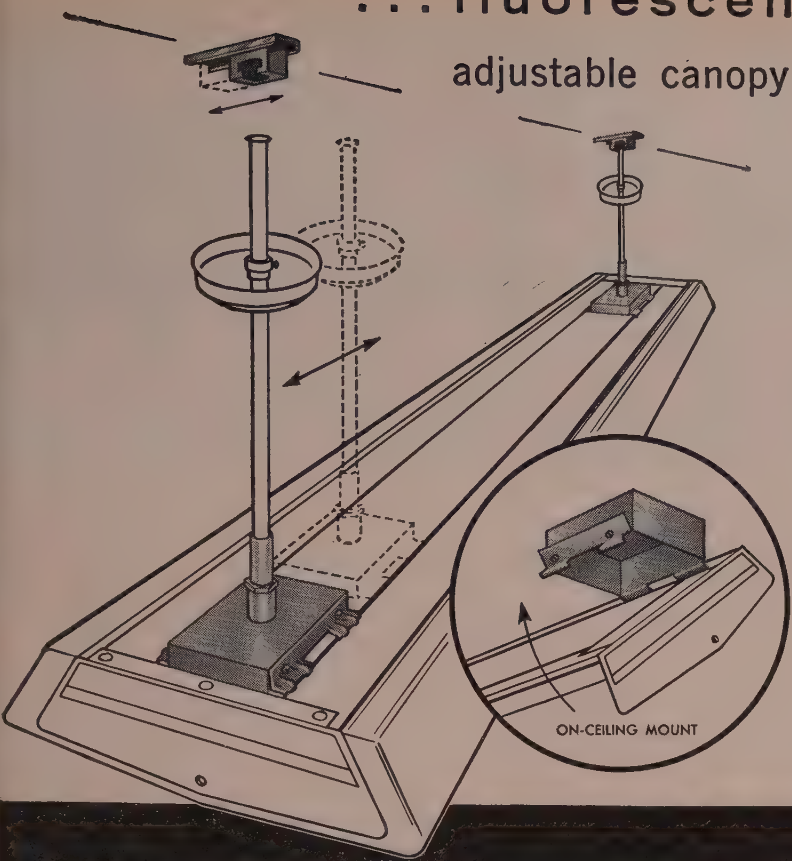
Since this system will be prescribed for a NASA workload amounting to some $1.3-billion over the next several years, and since this workload will be performed by general and specialty contractors, including those in the electrical industry, this explanation of program evaluation and review was of particular interest to conference delegates representing contracting organizations concerned with missile and spaceport electrical installation work.

Marketing

Chairman of the day was District Vice President Norman D. Ferguson who set the theme of the session in his opening talk, "Acres of Diamonds in your own Backyard." As Mr. Ferguson put it in the introductory part of his talk—"When we say 'diamonds' we mean

...fluorescent PHOTOMETRIC

adjustable canopy and sliding clamp hanger



Time saved is money saved. From the ceiling strap which permits lateral adjustment up to 1″ in either direction, the hook-on stem which makes one-man installation easy, the threaded stem which makes leveling the fixtures so simple, to the sliding clamp hanger which allows for final adjustments, Wakefield has developed a series of striking features to keep installation costs at a minimum. Note that the sliding clamp hanger is also used for on-ceiling mounting. If you are a Wakefield customer you *know*, if not, try Wakefield and be *convinced.*

Wakefield Lighting Division
VERMILION, OHIO
Wakefield Lighting Limited
LONDON, ONTARIO

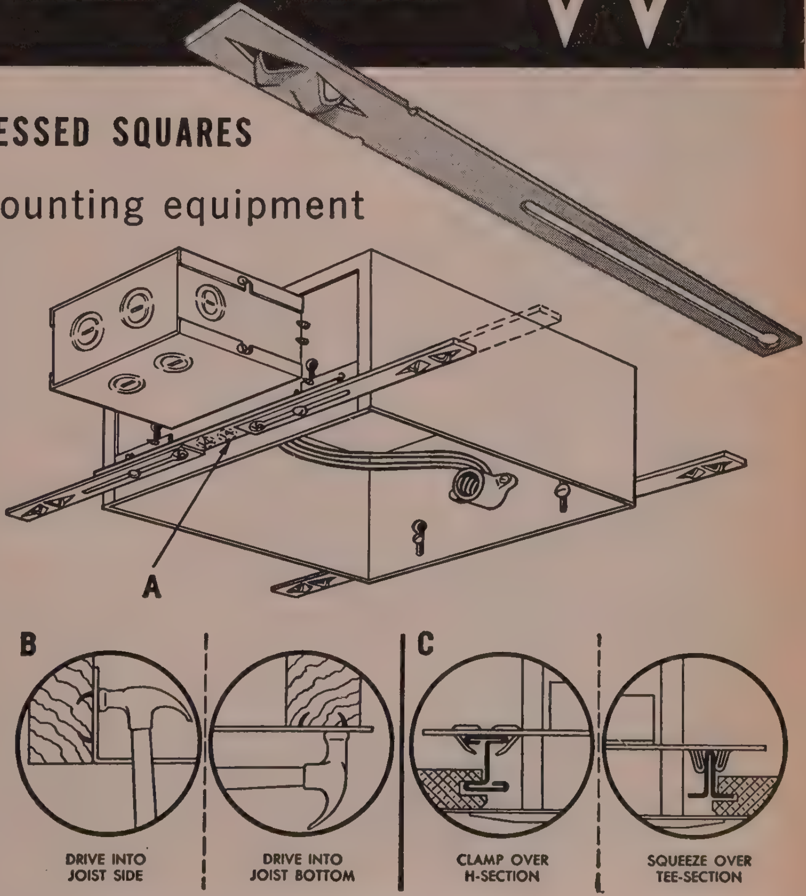
Time Saving Mounting Features by WAKEFIELD CORPORATION

...incandescent RECESSED SQUARES

clinch-cleat adjustable mounting equipment

Look at the illustration. Note that the side rails are stamped for pre-setting to either 14″ or 16″ joist centers (A). Next, you will see how the mounting bar provides for attachment to either the bottom or side of wood joists *without nails, staples or screws* (B). This is our famous Clinch-Cleat Attachment which also provides for mounting in acoustic tile mechanical suspension systems. The Clinch-Cleat clamps over H-sections or squeeze-fits over Tee-sections as shown in the sketches (C).

Art Metal Lighting Division
1814 EAST 40TH STREET, CLEVELAND, OHIO
Wakefield Lighting Limited
LONDON, ONTARIO



FISH TAPE REEL WITH
TAPE-MATE® ATTACHMENT

Protects your hands . . . saves tape . . . speeds winding! Wrap-around design keeps Tape-Mate on reel. Hands are in complete control—no need to touch tape. You simply push Tape-Mate "around reel" to wind . . . and pull it back to pay out. That's all!
Two sizes fit 8⅜" and 12" dia. reels.

CONVERT YOUR PRESENT REELS...OR GET COMPLETELY ASSEMBLED UNITS: REEL, FISH TAPE AND TAPE-MATE

SPECIAL CHROME PLATED UNIT
For the man who wants the best. Tape-Mate assembled on chromium plated reel. Special steel tape included. Long lasting.

SEND NEW "HI" CATALOG

NAME
FIRM
STREET
CITY STATE

HOLUB INDUSTRIES, Inc.
442 ELM ST. • SYCAMORE, ILL.

that there is a tremendous amount of profitable business in your own home town which has never been touched by you through a creative sales effort. . . . Most of you still get your business in the competitive business rat race which shows very little profit and requires no sales effort. . . . I am going to tell you about NECA sales tools so that you can use these tools to dig some diamonds in your own backyard."

His address covered the many "tools" that NECA has made available to electrical contractors to enable them to become active sellers of their services, rather than low-bidders on their services.

The data on NECA sales tools covered in the talk and the skit included the following highlights:

The Sales Institute is a five-day intensive sales training course designed to show contractors how to develop and promote more profitable business through practical and systematic selling.

Sales Training—They are available for use at the NECA chapter level, one for residential sales and the other for commercial, industrial and institutional sales.

Advertising—"Our advertising program now has a special advertising target—the modernization market. NECA now features you, the electrical contractor, in the ads and lists your special services. This year you will have a total of 34 full-page insertions in nine publications which will reach five million readers."

Sell-by-Mail Kit—"The Marketing Committee has put the national ads into a Sell-By-Mail Kit which makes it possible for you, the NECA member, to use these ads in your own local area."

Electric Comfort Promotion—"This promotion has been developed as a part of your long-range objective to develop complete promotion and sales plans for each of six principal markets which are discussed in the Sales Institute. This promotion features the package sale of Certified, Guaranteed, Bonded (CGB) Electric Comfort Systems designed, installed and serviced by NECA members.

Cooperative Sales Plans—A number of manufacturers and distributors have visited NECA headquarters to consult with staff members about developing cooperative sales plans keyed to the contractor.

Salesman Hiring Kits—"We encourage contractors in our Salespower Program to engage in creative selling themselves. The contractor eventually will reach a point where he will hire salesmen. To assist him in selecting and hiring salesmen, we have a kit available for $3.50.

"The diamonds are there right in your own backyard. All you have to do is get out and do a little digging. Remember, nothing really happens in this industry until somebody sells something."

All-Industry Cooperation

A presentation of skits and talks was effectively used to show the effects of all-industry cooperation and how the Twin Cities chapter of NECA and the Northern States Power Company worked together on an electric heating program. Moderated by A. H. Kessler, executive secretary of the North Central Electrical League, Minneapolis, Minn., the presentation was entitled, "Out of Organized Confusion. . . . Partners in Progress." It covered NECA's CGB Electric Comfort Program in action.

Kessler set the stage for the skits and talks with an opening address in which he stressed the importance of harmony among the various members of the electrical industry in accomplishing common objectives. The team — electric utilities, contractors, manufacturers and distributors—must work together in an atmosphere of mutual confidence and understanding.

The talks in this presentation were given as follows, with an excerpt from each:

P. B. Tripp, Tripp Electric Co., Minneapolis, Minn.—Adequate Wiring. "We all knew that a contractor must battle price and competition every foot of the way, and it was most pleasant to know that we had support and assistance in selling residential wiring. We soon found we were making progress and the number of homes certified began to increase and as the program developed, it was most gratifying that our Adequate Wiring Standards were accepted as reasonable and feasible by building contractors and by customers."

W. N. Collins, Collins Electrical Construction Co., St. Paul, Minn.—New Wiring for Old Homes. "In the early days of HOUSEPOWER, it was recognized that in order to be successful, our promotion had to be an all-industry effort. Everyone had a stake in the problem and everyone felt that all should take part. The first step was to organize our Twin City Rewiring Com."

H. E. Fraser, Langford Electrical Corp., Minneapolis, Minn.—Contests and Promotions. "But as I

TOOLS THAT MAKE MORE MONEY!

B-M { THE ORIGINAL INDENTER TOOLS / THE ORIGINAL INDENTER FITTINGS

These are the tools and fittings that have revolutionized setting up thin wall conduit. B-M, the Original Indenter Tools have been working efficiently for over 25 years—doing more work easier and lowering installation costs. Now, B-M Indenters have been re-engineered and redesigned to reduce size and weight to increase efficiency and ease of operation. These B-M Indenters with the new patented compound leverage are now only plier size. They are lighter to carry, easier to use and the leverage does the work.

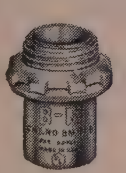
B-M, the Original Indenter Fittings go with B-M Indenter Tools like ham and eggs. Contractors who demand the best always call for the Original B-M Fittings for the soundest, most permanent installations possible. The fittings are concrete tight and vibration resistant. All steel, heavy gauge fittings are heavily bright zinc plated and have been salt spray and acid drip tested for corrosion resistance. Additional features are extra heavy bonding locknuts. Smoothly rounded edges or bushed throat type connectors make fishing easier and prevent damage to insulation.

For fast, safe installation plus complete protection always specify the Original B-M Indenter Fittings and the Original B-M Indenter Tools.

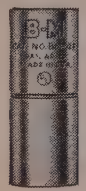
ACTUAL SIZE

THE NEW POCKET SIZE TOOLS!

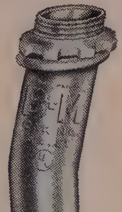
The rugged, light weight No. 607 Indenter for ½" fittings is shown here full size.



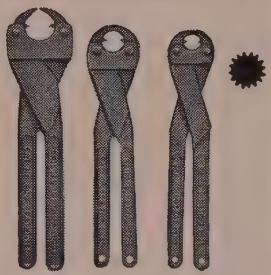
BM-21B
½" Connector
BM-22B
¾" Connector
BM-23B
1" Connector



BM-41
½" Coupling
BM-42
¾" Coupling
BM-43
1" Coupling



BM-51
½" Offset Connector
BM-52
¾" Offset Connector



***BM PLIER SIZE INDENTERS**
BM—No. 609 1" BM—No. 608 ¾"
BM—No. 607 ½"

BRIEGEL METHOD TOOL CO.

GALVA, ILLINOIS

All B-M indenter type fittings far exceed the requirements of U. L. file card E 10863 and Federal Specifications W-F-406.

*BM 51 and 52 offsets are not listed as concrete tight.

USED THE MOST FROM COAST TO COAST

Pretty receptionist flips Sno-Melter switch; clears snow from shipping docks, truck ramps, walks!

Shall we hold a wake for the old snow shovel? The modern snow removal system—Sno-Melter—operates at the flip of an electric switch. Operates economically, too, because warm-up and melt-off time are far faster than with any heated liquid system.

Constructive way to use spare electrical capacity which is freed when air conditioning goes off!

Installation? Compare the old method of laying a maze of circulating pipes, with a modern Sno-Melter. This system incorporates pre-spaced, anchored resistance wire in mats which roll out like rugs as concrete is poured.

Standard sizes cover 4 to 90 square feet—dissipate either 42 or 60 watts of uniformly even heat per. Other sizes on special order.

Now, firms whose truckers used to spin their wheels every winter can start them out on solid ground. A company's customers will always find a clear path to its dock. And maintenance crews, with no more snow to shovel, nor ice to chop, can be more productive.

Better get the facts on Sno-Melter on file; you're going to want to recommend it. Write for detailed 4-page folder.

EASY-HEAT INC.
"Electric Snow Removal Equipment"
Dept ECM New Carlisle, Ind.

said before, once in awhile, anyone has a tendency to let down. In order to stimulate business, certain contests and promotions have been developed. I would like to describe one very briefly: Recently the Northern States Power Company conducted a commercial lighting contest. Quotas were set, along with a system of point values for certain commercial installations. If a contractor made his quota, he was invited to attend a 2½ day outing at a fine northern Minnesota resort."

G. Clausen, Kostka Electrical Contractor Inc., St. Paul, Minn.—Electric Heat. "When the news of the special rate for electric heating was announced by Northern States Power Company, things began to happen fast. . . . Through a series of meetings and training schools, all of us began to know more about this new and complex addition to our industry, and as we learned more about electric heating, we began to see that more knowledge and additional information was needed.

"As has been mentioned, the Upper Midwest Electric Home Heating Manual was written under the sponsorship of our North Central Electrical League. This was a tangible guide to help solve some of our local problems."

And as Kessler added, "They said it couldn't be done . . . heat homes electrically in an area with 7,853 degree days. But, we had a lot of doubting Thomases up here, who said, 'Let's see for ourselves!' Was electric home heating with its tremendous potential of new business for all branches of the industry possible, practical and profitable in the Upper Midwest? It took an All-Industry Committee dedicated to the job a full year to come up with the answer. It came in the form of the Upper Midwest Electric Home Heating Manual."

J. E. Stoddart, Vice Pres., Northern States Power Co., Minneapolis, Minn.—Industry Cooperation. This was a summarizing talk on the value of teamwork.

A talk on the importance of selling by electrical contractors was given by Porter Henry, Jr., sales training consultant of New York City. In his talk, "Dig for Diamonds," he made the following points:

"Although the contractor can offer services that would increase the profit of nearly every store, factory, or office building in the country," Henry said, "he is reluctant to go out and tell people about it. In his mind the word 'selling' is too often associated with high-pressure, unethical methods."

C. G. Nelson, Commercial Electric Co., Duluth, Minn.; and Eric G. Nylund, Nylund Electric Co., Duluth, Minn.

"So maybe you don't like the idea of selling," Henry said. "But everybody likes to give advice. So just make a few personal visits to advise businessmen that you can increase their profits by providing better lighting, better power distribution, better electrical maintenance.

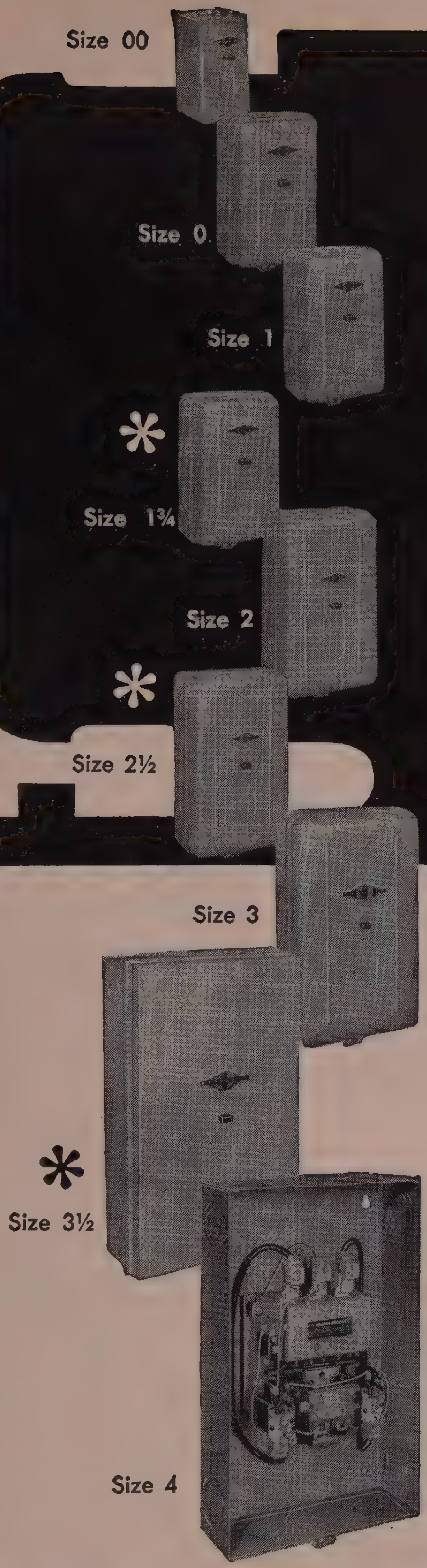
Labor-Management Relations

The need for continued and improved cooperation between labor and management to maintain competence and remain competitive was the theme of the fourth general membership session. Such cooperation must begin at the local level to regain or continue to hold the amount of business available to the electrical contractor, stated James E. Swan, NECA director of labor relations.

He reported that some areas have tried multiple wage scales—a lower rate for house wiring—to capture more of the residential wiring market. But, this alone has not been enough. Recent surveys indicate that both contractor and union electricians must have a sincere and honest desire to do this type of work. Mechanics must accept residential wiring assignments as well as others and must be willing to give the contractor and public an hour's work for an hour's pay. Swan suggested that local labor-management groups include house wiring in their apprenticeship programs and, if necessary, develop journeyman training programs to gain this market.

Cooperate and participate in local apprenticeship programs to train young men to be competent, advised L. B. Baker, NECA director of apprenticeship and training. Re-

MATCH THE STARTER TO THE JOB



5 out of ten Motor Applications (10 to 75 hp) are Satisfied by Furnas Exclusive Sizes 1¾, 2½ and new 3½

Now you can match the starter to your exact horsepower requirement, eliminating wasted space and capacity (and cost). Only Furnas offers a *really* complete line of motor starters through Size 4. Our *exclusive* Sizes 1¾, 2½ and new 3½, all standard with Furnas, meet the horsepower/motor ratings between 10 and 75 hp that are not covered by the usual size starters. You'll find that Furnas horsepower rated starters do the job better, more economically.

Write today for full information—Bulletin 14-B5.

FURNAS ELECTRIC COMPANY

Sales Representatives in All Principal Cities

FURNAS

Write today for full information
1067 McKEE STREET, BATAVIA, ILLINOIS

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Midwest
WEATHERPROOF
POWER OUTLETS
FOR FARMS, RANCHES, CONSTRUCTION AND MOBILE HOME PARKS.

U-L APPROVED
FOR PROTECTION!

MODEL P 24 GC

There are over 150 Midwest Power Outlets in Circuit Breaker and Fused Models to choose from.

All major Midwest Power Outlet Models are U-L Approved.

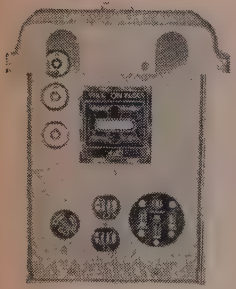
FAST . . . LOW COST INSTALLATION!

MODEL P 55-C

All panels are prewired. Each power outlet has solderless terminals for fast installation.

A hub in the top and K.O.'s in the bottom facilitate overhead and underground wiring.

COMPLETELY WEATHER-PROOF—TAMPERPROOF


MODEL P 73 F

Covers close completelv while in use and can be padlocked to eliminate tampering.

Midwe-t Power Outlets are constructed of heavy gauge electro-galvanized steel with a gray baked enamel finish.

New Catalog on Request!

SEE YOUR LOCAL ELECTRICAL DISTRIBUTOR OR WRITE—

Midwest
ELECTRIC PRODUCTS, INC.
DEPT. 1515—MANKATO, MINNESOTA

minding contractors that they have an investment in apprentices, he cautioned against using them as a source of cheap labor to gain a competitive advantage.

Gordon M. Freeman, president of IBEW, told convention delegates that we are not turning out qualified journeymen fast enough to provide the skilled labor force this nation needs. We must step up our efforts to keep pace with the rapidly changing electrical industry or be left behind, he warned. While reviewing the present labor market and IBEW programs, he gave the following specifics:

Available Market—The annual U. S. market for electrical contractor services is about $15 billion which should provide employment for about 500,000 electrical workers. At present there are about 12,000 electrical contractors employing approximately 130,000 IBEW members. There are over 300,000 electrical workmen, either self-employed or employed by those outside our industry, who are doing electrical installation, maintenance or repair work.

House Wiring—President Freeman has instructed his vice presidents, international representatives and local unions concerning the necessity of IBEW members doing house wiring, repair work, etc., and he sees improvement in this field.

Apprenticeship Training — A step-up is needed in this program. Considerable improvement has been made in quality; now we need to move up in quantity. The number of joint apprenticeship agreements jumped from 320 in 1957 to 706 in 1960.

Future Negotiations—The recent IBEW convention in Montreal went on record favoring a shorter work week where necessary, and instructed its international officers to work toward securing increased pension benefits from the contractors.

Discussing America's Future in the Age of Space Science and Technology, Congressman Joseph E. Karth (Dem.-Minn.), Chairman of the Space Sciences Subcommittee of the House Committee on Science and Astronautics, pictured colonies of human beings pushing the frontier for the human race out into the solar system.

As a result of our space age research and technology, Congressman Karth sees new industries emerging with more employment. And the electrical industry will play an important role in this development, he predicted.

IAEL Conference Held in Chicago

The International Association of Electrical Leagues held its 27th Annual Conference at the Sheraton-Chicago Hotel, October 3-5. Some 70 electric association executives, dedicated to promote acceptance of new electrical equipment and applications in their respective areas, attended sessions to review past accomplishments and seek benchmarks for future activities.

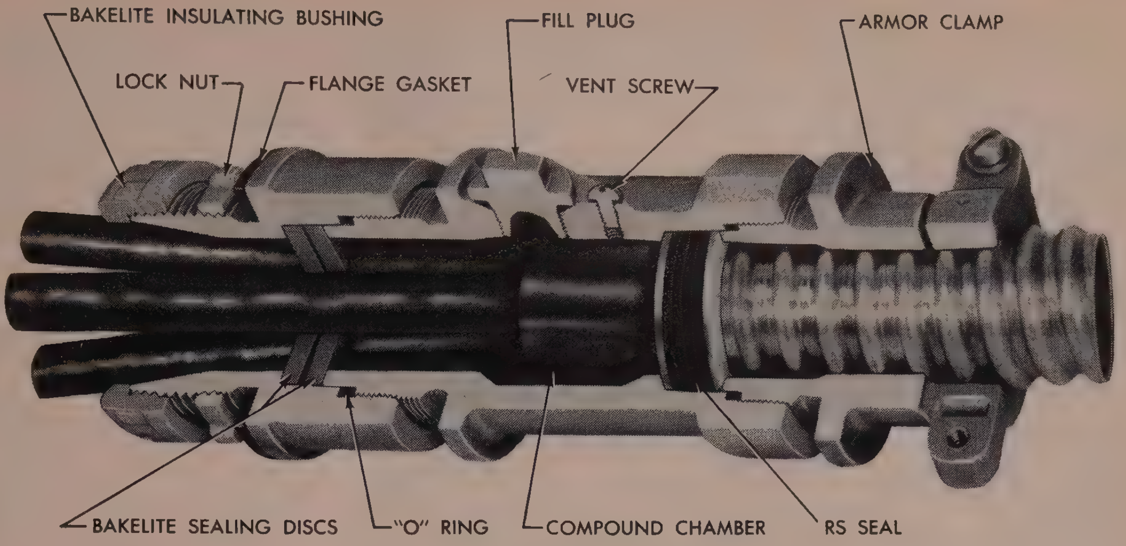
IAEL President R. J. Harrison, Nebraska-Iowa Electrical Council, Omaha, keynoted the conference when he recounted solutions of local problems through a cooperative exchange of ideas between other league managers. Several important market areas throughout the U.S. have no local league organizations. To help interested groups to establish such an organization, an IAEL committee chairmanned by Herb Cook of Detroit has developed a prototype constitution and set of by-laws, he revealed.

The legal aspects of trade association operation were reviewed by Herman L. Taylor, Essington, McKibbin, Beebe and Pratt, a Chicago law firm with several association clients. Be satisfied with purely educational and persuasive promotional programs and stay away from any concerted action about so-called "trade abuses," he advised. Statistical reporting and information on which members can make individual decisions comprise good association activities, he added. Any program designed to promote the interests of all members and the industry as a whole is generally proper and legal, he concluded.

With the aid of comprehensive charts, economist Dr. Beryl Sprinkel, vice president, Harris Trust and Savings Bank, Chicago, presented the current economic picture. While high points have been reached this year, dissatisfaction exists because full employment has not been attained and the rise in the economy has not been as rapid as predicted, he noted. Based on leading statistical indicators, Dr. Sprinkel expects downward movement in the economy in the next six months.

Appliance dealers are having their economic problems too, reported S. M. Boyd, Springfield, Mass., president, NARDA. A survey of NARDA members revealed these sore spots: not enough gross margin in prices to provide for adequate promotion and service; not

New from the only manufacturer of *all* cable accessories . . .



G&W Series 800
Interlocked Armor Cable Fittings

. . . accommodate all commercially available interlocked armor cable
. . . reduce installation time and effort
. . . available for immediate delivery

New G&W Series 800 Fittings not only terminate, but support, ground, mount, and dead end on the widest variety of applications. They offer simplified, modern design in only four basic pipe sizes to accommodate all interlocked armor cable now being manufactured. Eight different fittings in each size means faster installation from simple armor clamps to compound-filled terminations used in any position.

CHECK THESE SIGNIFICANT FEATURES:

- **High strength aluminum parts**
- **Resistoyl® gaskets**
- **RS seals proven on potheads, boxes, and switches**
- **Interchangeable components**
- **Water-tight construction**

G&W's Series 800 Fittings are an important addition to the only complete line of cable accessories available . . . G&W also offers the *best* engineering information service to assist you in any of the following areas:

Potheads . . . Terminating Kits . . .

Splice Kits and Boxes . . . Joints . . .

All high and low voltage Cable Accessories

Further proof that you save time and money by relying on the dependability of G&W's constant product development. For the detailed story on the new Series 800 Fittings, mail the coupon below for your copy of Catalog H.

superior quality standards
— inspired specialized designs

H60-1

G&W ELECTRIC SPECIALTY COMPANY
3500 West 127th Street • Blue Island, Illinois

☐ Send me a copy of Catalog H detailing facts about the new G&W Series 800 Interlocked Armor Cable Fittings.

I specify interlocked armor cable for the following applications:

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Name and Title:____________________

Company:____________________

Address:____________________

City:__________ Zone:______ State:__________

QUAD
REFLECTORS

4 Simple Steps to Good Lighting..

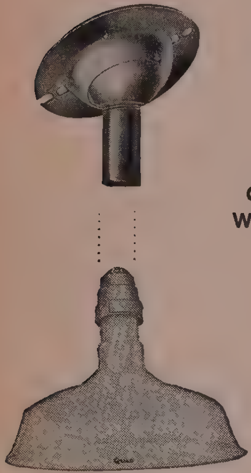
1 • Attach QUAD Swivel Aligner to outlet box.

2 • Add one piece of conduit cut to desired length.

3 • Thread on QUAD REFLECTOR of your choice.

4 • Install lamp of suitable wattage.

example:



Porcelain Enamel Finish

Take Your Q From

QUAD

Complete line of many shapes, sizes and choice of socket fittings

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32 S. Peoria Street
CHICAGO 7, ILLINOIS
Member RLM

enough net profit to permit building an operating reserve.

The application of the thermoelectric principle to appliances places us on the threshold of an entirely new field, stated A. P. Boehmer, manager of appliance research, Roy C. Ingersoll Research Center, Borg-Warner Corp., Des Plaines, Ill. Explaining the theory and mechanics of thermo-electric cooling, he noted that, while material prices are still high, the quiet operation and flexibility of such appliances should develop a market.

Noting the market upswing in the home entertainment field, E. R. Taylor, president, Motorola Consumer products, Inc., Franklin Park, Ill., enumerated a number of interesting new developments that will reach the market in the near and distant future. Among them are: Thinfilm (micro-miniature) integrated circuits to improve reliability; stereophonic sound for TV; improved playing mechanisms for tape recordings; more transistors in TV sets; smaller and more reliable color TV; tape mechanisms to record home TV video and sound; ultrasonic window washers; and an electronic ignition system for cars.

George W. Clark, marketing manager of fluorescent lighting fixtures, Sylvania Electric Products, Inc., Wheeling, W. Va., discussed the application and operation of the combination air-handling and lighting fixtures; illustrated applications in several office buildings where heat from lamps and ballasts is being used to heat the structure. With current concern about economics and total environment, we are rapidly approaching a point where integrated design is a paramount goal in construction, he predicted, adding that the air-handling lighting fixture fits such a concept.

Programs to Promote

Delegates seeking promotional program ideas were given several to consider.

Successful use of central air conditioning as a new home feature—the "Crowning Touch" program tested in Wilmington, Del., can be another effective league promotion, stated James P. Gallagher, associate editor, *House and Home* magazine, New York. Last year, 32% of all new homes sold in this test area had central air conditioning and participating builders, in the face of a 5% decline in home building, sold 13% more homes than in 1960, he reported. A 1962 program in Philadelphia is being sponsored by the Electric Association of Philadelphia and 1963 programs are being planned for Connecticut, and such areas as Chicago, Atlanta, Los Angeles and San Diego, he revealed.

Training courses devised by the Industrial Electrification Council can be effectively used as a league activity, stated John R. Murphy, Jr., manager, Industrial Electrification Council, New York. The IEC, jointly sponsored by EEI and NEMA, is dedicated to increased application of electrical energy and products in the industrial field. The success of two previous courses, Electric Process Heating and Industrial Power Distribution, has led IEC to prepare a new one called Lighting for Industry. Recently released in an 8-lesson format, it is designed to go after the industrial relighting market, he revealed.

The features of NECA's Certified, Bonded and Guaranteed Electric Comfort Heating Systems Promotion were outlined by M. J. Sherwood, director of marketing for the National Electrical Contractors Association, Washington, D. C. Through the program, the certified electrical contractor will be able to sell a complete electric comfort heating package including design, equipment, installation, insulation, financing and be in a position to guarantee operating costs for a period of three years, Sherwood explained. To date, some ten NECA Chapters have certified 315 contractors who have successfully completed the course, he revealed.

Local electrical associations and electric leagues can be a potent factor in the type of electrical industry image that is created. Much depends upon the local group's public relations program, warned Ted Cox, president, Ted Cox Associates, Chicago public relations firm. A good public relations policy requires evaluation of every project and action in terms of benefits to the various groups or people whom we want to persuade to buy more of the goods and services of our industry, he noted.

New Officers

IAEL officers elected at the conference were: president—Harry J. Foy, Electric Service League of Ontario, Toronto, Can.; vice president—Paul J. McMillan, Electric League of Chattanooga, Chattanooga, Tenn.; secretary—R. N. Ruecker, Valley of the Sun Electric League, Phoenix, Ariz.; treasurer—Harry Guest, St. Louis Electrical Board of Trade, St. Louis, Mo.

JET LINE® METHOD

GUARANTEED TO SAVE MONEY

every time you wire a conduit!

Jetmaster

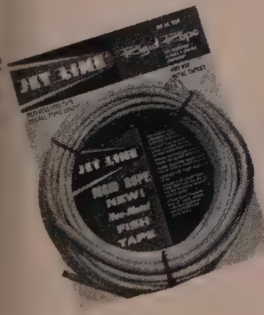
Pat. No. 2,930,584
Pat. No. 3,006,607

makes you a one-man gang for all conduit wiring jobs. Jetmaster combines the entire JET LINE Method into a single compact, easily portable unit — includes everything you need to pull wire quickly, easily, safely in any size, any type conduit ½" thru 4" I. D.

JET SET

Pat. No. 3,006,607

makes short work of wiring small conduit (½", ¾", 1" up to 2½" I. D., any length). Jet Set is a money-saving must for every crew, every truck.



Rigid Rope®

Pat. Pend.

makes dangerous metal fish tape obsolete for "fishing" conduit. Safe, non-conductive Rigid Rope is flexible, easy to push, never cuts. Lightweight, durable. In 25' 50' and 100' lengths.

You lose time and money every time you snake a conduit with metal fish tape! Why? Because if you had used the JET LINE Method, you'd have put a line through that conduit in seconds . . . and pulled wire **in minutes** instead of hours.

USE JET LINE® ALL THE TIME

The JET LINE Method makes short work of wiring any size, any type conduit — it's one piece of equipment you can't afford to be without! Contractors tell us that JET LINE saves them up to 70% of wire pulling costs on every job, large or small.

JET LINE® PAYS FOR ITSELF

Look at it this way. The JET LINE Method can pay for itself on just *one* job! In fact, every time you use your JET LINE equipment you can figure wire pulling in terms of *profits* instead of costs.

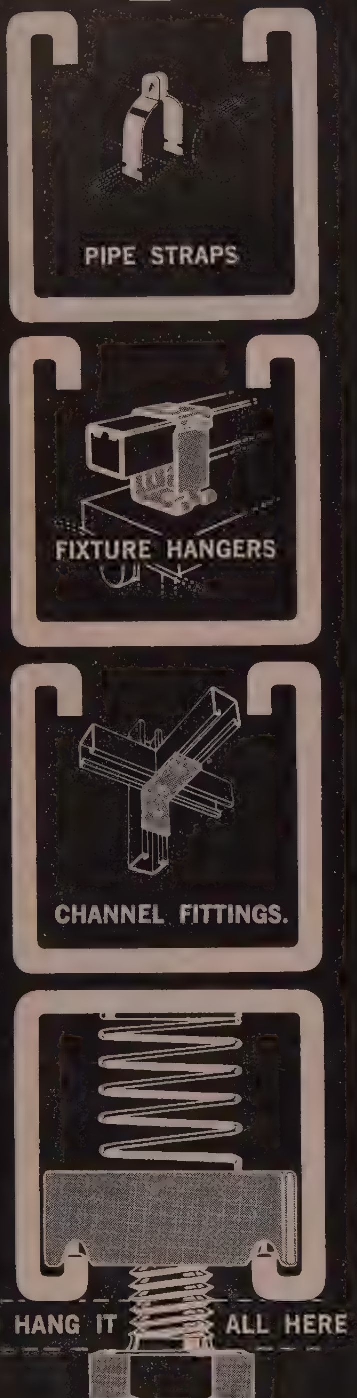
EVERY CREW, EVERY TRUCK NEEDS JET LINE®

Would you want to bid *against* a contractor that makes full use of the JET LINE Method? *Every* job is a job for JET LINE — you can't help but save time and money every time you use it!

For complete information and prices on the JET LINE Method, ask your distributor or write

JET LINE® PRODUCTS, INC.
305 Foster Ave. • Charlotte 3, N. C.

6766



HANG IT ALL
WITH
POWER-STRUT
CHANNEL

Write for free catalog which shows you how to save time and money on all your support jobs.
POWER-STRUT
DIVISION VAN HUFFEL TUBE
CORP., WARREN, OHIO

EASA News

Although the majority of independent electrical apparatus service shops are not large enough to justify installation of expensive automatic accounting machinery, a few are reporting highly satisfactory results from the use of some of the modern pieces of equipment that are appearing with increasing frequency throughout the country.

One firm, Tampa Armature Works, of Tampa, Fla., has been using automatic accounting machinery for five years, the firm's vice-president and treasurer, former EASA director Howard A. Lilly, reports. Machines leased or owned by his company include an IBM Bo. 402 accounting machine, an IBM collator, a combination punch and duplicator key punch, and a sorter. Use of the equipment has contributed to "the best balanced financial condition in our company's history," according to Mr. Lilly.

• • • •

As businessmen should plan carefully and precisely where they expect their companies to be three, five and even ten years from now, so should a trade association, comments EASA President Ben J. Horton, in calling for suggested goals for the international organization.

Mr. Horton has asked each of the 1,500 active members of EASA to send him their suggestions as to services and activities the organization should engage in in behalf of its members.

• • • •

August A. Baechle, EASA executive vice-president, has been named one of the directors of the sessions on rotating machinery that will be held as part of the Fifth Electrical Insulation Conference, scheduled to be held September 16-19, 1963, in Chicago.

• • • •

A well-known salesman of motor repair shop supplies has left his company to form his own business. D. A. James, for 17 years with Insulation and Wires, Inc., has launched the D. A. James Co., with headquarters at 911 St. Charles Street, in St. Louis, Mo. Magnet wire, lead wire, varnishes, sealers, enamels, resins, paper and tapes are among the products handled by the new company.

• • • •

Honored last month as "EASAN of the Month" was Benjamin F. Whaley, of Columbia, S. C., founder and owner of Whaley Electric Service. Mr. Whaley was recogniz chiefly for his service to EASA Southeastern Chapter, of which is secretary.

• • • •

While more and more motor m are talking around diversifying t repair industries—that is, branc ing into manufacturing, ele tronics, and other related activiti —a loud dissent has been hea from Iowa. In Cedar Rapids, Juli Hupp, owner of Electric Moto Co., asserts that there is still mo repair work than the nation's ind pendent shops can handle—*if* th would go out and get it.

"When one manufacturer alo has turned out a million motors the last ten years, what addition proof do we need that there will more, not less, service work?" as Mr. Hupp.

The Iowa businessman, who company is celebrating its 50th a niversary, reported that a mark research firm reported its sal were only one-tenth of the potenti in its trading area. "And w thought we were doing great!" said.

• • • •

An example of how motor sho are branching out into related bus nesses can be found in Detroi Mich., where the Howard Electr Co., one of the Motor City's large shops, is turning tidy profits fro its "Silent Sewage Ejector," a com bined pump and alternator packag for use in places where conve tional plumbing is unavailable.

Since launching the operati four years ago, Howard sales hav climbed to about 500 of the units year. The units come in a variet of sizes, and have been approv by the FHA.

• • • •

Another tour of a motor manu facturing plant was made by a EASA group on October 15 whe members of Great Lakes and West ern Michigan chapters visite Howell Electric Motors Co.

• • • •

EASA President Ben J. Horton schedule this fall has been a bus one, keeping him away from hi home in Pittsburg, Kansas, nearl every weekend. Among the mee ings he has attended have been th EASA Tri-Chapter Conference i Minneapolis, Minn.; the Northeas ern Conference, in Cleveland, Ohi the Chapter Officers' Conference, i St. Louis; the Pacific Northwe Conference, in Seattle, Wash.; th Southwestern Chapter meeting, i Waco, Texas; and the Southeaste Chapter meeting, Jacksonville, F

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DATES AHEAD

National Electrical Manufacturers Assn.—Annual meeting, Shoreham Hotel, Washington, D. C., week of November 12.

Electrical & Home Appliance Show—Balboa Park, San Diego, Calif., November 23-28.

Building Research Institute—Fall conference, Mayflower Hotel, Washington, D. C., November 27-29.

Lighting Industry Show—Dunes Hotel, Las Vegas, Nev., December 2-5.

National Rural Electric Cooperative Assn.—21st annual meeting and exhibition, Convention Center, Las Vegas, Nev., January 14-17, 1963.

Institute of Electrical and Electronic Engineers—Winter general meeting, New Yorker, Statler Hilton and Coliseum, New York, N. Y., January 27-February 1.

Electrical Engineering Exposition—Sponsored by AIEE, Coliseum, New York, N. Y., January 28-31.

Plant Engineering and Maintenance Show—McCormick Place Exposition Center, Chicago, Ill., January 28-31.

Intermountain Electric Assn.—Annual conference, New House Hotel, Salt Lake City, Utah, February 7.

Power & Communication Controls Assn.—18th annual convention, Granada Hotel, San Antonio, Texas, February 10-12.

National Electrical Week—National Promotion, February 10-16.

16th International Heating & Air Conditioning Exposition—Coliseum, New York, N. Y., February 11-14.

4th Biennial Electrical Manufacturers Exposition — Veterans Memorial Bldg., Columbus, Ohio, February 12-14.

Upper Midwest Electrical Industry Convention—Radisson Hotel, Minneapolis, Minn., February 17-20.

Annual Wiring Sales Conference—Pfister Hotel, Milwaukee, Wis., February 20-21.

4th National Lighting Exposition & World Lighting Forum—Coliseum, New York, N. Y., March 3-6.

Associated General Contractors of America—44th annual convention, Americana Hotel, New York, N. Y. March 4-7.

4th Southeastern Plant Engineering and Maintenance Exosition — Merchandise Mart, Charlotte, N. C., March 5-7.

Home Improvement Products Assn.—HIP Show and Convention, Park-Sheraton & Coliseum, New York, N. Y., March 10-15.

Assn. of Electronic Parts & Equipment Mfrs., Inc.—Annual meeting, Chicago, Ill., March 12.

Electrical Association of Kansas City—Industrial trade show, Municipal Auditorium, Kansas City, Mo., March 19-21.

Third Alabama Electrical and Electronics Exposition—Municipal Auditorium, Birmingham, Ala., April 1-3.

Edison Electric Institute—29th annu sales conference, Edgewater Bea Hotel, Chicago, Ill., April 1-3.

Biennial Progress in Electrical-El tronic Equipment Exhibit—Kiel A ditorium, St. Louis, Mo., April 2-4.

Missouri Valley Electric Assn.—A nual engineering conference, Mue lebach Hotel, Kansas City, M April 17-19.

Rocky Mountain Electric League Spring conference, Harvest Hous Boulder, Colo., April 21-23.

National Industrial Production Sho of Canada — Exhibition Park, T ronto, Ont., May 6-10.

Electric League of Cleveland—Elect cal show for industry, Clevela Public Auditorium, Cleveland, Ohi May 7-9.

National Fire Protection Assn.—A nual meeting, Hilton Hotel, Por land, Oregon, May 13-17.

National Association of Electrical Di tributors—55th annual conventio Municipal Auditorium, Jung an Monteleone Hotels, New Orlean La., May 21-25.

Edison Electric Institute—31st annu convention, Denver, Colo., June 3-

Electrical Apparatus Service Associ tion — Annual convention, Statle Hilton Hotel, Dallas, Texas, Ju 9-12.

N. Y. State Assn. of Electrical Co tractors & Dealers—Annual conve tion, Whiteface Inn, Lake Placi N. Y., June 30-July 5.

National Association of Lighting Mai tenance Contractors — Conventio New Orleans, La., August.

Illuminating Engineering Society—Na tional technical conference, Sheraton-Cadillac Hotel, Detroit, Mich September 8-13.

International Association of Electrica Inspectors—Northwestern Sectio Salt Lake City, Utah, Septembe 9-11, **Southwestern Section**, Tucso Ariz., September 16-19; **Easter Section**, Atlantic City, N. J., September 23-25; **Western Section**, Omaha Neb., September 30-October 2 **Southern Section**, Norfolk, Va., October 14-16; **Canadian Section**, November 1-2.

Rocky Mountain Electric League — Broadmoor Hotel, Colorado Springs Colo., September 18-21.

Canadian Electric Manufacturin Assn.—18th annual meeting, Sheraton-Brock Hotel, Niagara Falls, Ont October 2-4.

Indiana Electric Assn.—Annual convention, Sheraton Hotel, Frenc Lick, Ind., October 2-4.

International Assn. of Electrica Leagues — 28th annual conference Read House, Chattanooga, Tenn. October 2-4.

National Electrical Contractors Assn —Annual convention, Los Angeles Calif., October 7-12.

National Electrical Manufacturer Assn.—Annual meeting, Edgewate Beach Hotel, Chicago, Ill., Octobe 21-24.

National Electronics Conference—McCormick Place, Chicago, Ill., October 28-30.

an
editorial
by
hromalox

how long will some contractors pass up profits in electric comfort heating?

Electric comfort heating is one of the greatest opportunities to hit any industry in many a decade! There's a big, fast growing market ready and waiting for us in the electric industry to sell and service. The products are *right;* the installed costs are *right;* the operating costs are *right.*

But the number of *electric* comfort heating installations is not keeping pace with the market potential. True—many alert and aggressive electrical contractors have picked up the ball. They sell, install and service electric comfort heating jobs at a good profit. In fact—some contractors find it so profitable, they specialize in electric comfort heating.

There are other contractors who recognize some of the potentials in electric comfort heating. They've gone so far as to look into the different products available and attend workshops on electric comfort heating. But that's about where their efforts end. Yes, they get a *few* profitable jobs but they don't pursue a fraction of their potential sales avenues for comfort heating . . . new and remodelled stores, apartments, buildings, motels, hotels, hospitals, offices—to name a few.

Then there are those electrical contractors who have simply ignored comfort heating. They go about their business of providing wiring, service outlets, control systems and other work the craft traditionally handles. But—they have a "blind spot" when it comes to merchandising electric comfort heating equipment.

Whichever class of contractor you fall into—if you really want to realize the full potential of electric comfort heating—Chromalox will work with you. We will supply you with equipment data, job planning methods, necessary sales aids. Over 40 Chromalox field offices and over 1,000 authorized Chromalox distributors can provide installation data, help insure prompt delivery, give you all the assistance you need to sell and service your local market.

The opportunity is NOW

Write Chromalox today. Ask for bulletin G-00500. It details the facts, opportunities and profit potentials in the booming electric comfort heating market. WC-15

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Among the Manufacturers

Headquarters Announcements

General Railway Signal Co., Rochester, N. Y., and **Edwards Co.,** Norwalk, Conn., have announced their merger. The plan also proposes a new name, **General Signal Corp.,** for the parent company with Nathan R. Owen as chairman, R. Stafford Edwards as vice chairman of the board, and P. W. Smith as president. The Rochester facility will continue under its original name, as would the Norwalk concern, which also operates a plant in Pittsfield, Maine.

James G. Biddle Co. has moved to new offices at Township Line & Jolly Roads, Plymouth Meeting, Pa.

Electric Products Co., Cleveland, Ohio, announced the purchase of the line of industrial dc motors and generators manufactured by the **Crocker Wheeler** operation of the **Elliott Co.,** Jeanette, Pa., a division of **Carrier Corp.**

Diehl Mfg. Co., Finderne, N. J., has purchased the assets of **Air Marine, Inc.,** Plainview, N. Y. and its wholly owned subsidiary, the **Motordyne Corp.,** Los Angeles, Calif., from the **Mite Corp.,** New Haven, Conn.

The formation of the Prescolite Div. by consolidating the electrical products, automotive batteries and wire and cable divisions of **The Electric Autolite Co.,** Toledo, Ohio, into one unit has been announced. L. L. Garber, vice president, has been named general manager and Earl R. Fiene, vice president, will be director of sales of the new division.

Lapp Insulator Co., Le Roy, N. Y., has recently purchased **Ceramaseal, Inc.,** New Lebanon Center, N. Y. Officers of Ceramaseal will be: Brent Mills, president of Lapp, president; Stanley C. Killian, vice president of engineering for Lapp, executive vice president.

General Electric Co., Nela Park, Cleveland, Ohio — Donald D. Scarff, general manager, Lamp Div.; Thomas W. Wallace, general manager, Large Lamp Dept.

Reliance Electric and Engineering Co., Cleveland, Ohio—William J. Hall, manufacturing manager; Heinz G. Henning, manager of purchasing; Granger H. Collens, chief industrial engineer; Ivanhoe Div.

Sylvania Electric Products In Salem, Mass.—Leo E. Duval, ma ager of product engineering formation services, Commerc Engineering Dept.; Joseph J. Ja man, manufacturing manager incandescent lamps; Lighti Products Div.

Commercial Controls Cor Rochester, N. Y.—Robert E. quignot, secretary and treasure

Nelson Electric Mfg. Co., Tul Okla.—Jack R. Jacobs, marketi manager.

Supronics Corp., Perth Amb N. J.—Emanuel Davis, gene manager, O. K. Electric Supp Div.

Standard Wire and Cable C Los Angeles, Calif.—Lawrence Seerden, director of marketing.

Lau Blower Co., Indianapol Ind.—George H. Will, sales ma ager, electric heat, Meier Div.

Allis-Chalmers Mfg. Co., M waukee, Wis.—J. L. Singleto senior vice president was nam principal engineering officer; P. Bauer, senior vice president a head of Industries Group; Jo W. Carlson, vice president.

Philadelphia Electric Co., Phil delphia, Pa.—R. G. Rincliff chairman of the board; H. Ramsey, president; R. F. Gilkeso executive vice president and mem ber of the board of directors; J. Harlow; vice president in charg of engineering and research; A. Mitchel, vice president in charg of finance and accounting.

Kennecott Copper Corp., Ne York, N. Y.—Charles G. Stradell board of directors.

American Electric Mfg. Cor Memphis, Tenn.—James E. Fre man, marketing manager.

J. B. Nottingham & Co., Inc New York, N. Y.—Richard Snyde chief engineer.

Carol Cable Co., Pawtucket, R. —Samuel B. Alperin, manager sales operations.

Bell Television, Inc., New Yor N. Y.—Lee Bunting, chairman the board.

Elmwood Sensors, Inc., Prov dence, R. I.—Francis T. McAvo Jr., sales manager.

Triangle Conduit & Cable Co Inc., New Brunswick, N. J.— Donald W. Droll, Edwin H. Muder lak and Rex E. Larsen, commercia vice presidents.

Electronic Specialty Co., Lo Angeles, Calif.—A. W. Chaffee general sales manager.

Gould-National Batteries, Inc St. Paul, Minn.—G. P. Millingto Jr., general sales manager, Indus trial Battery Div.

Bunting Brass and Bronze Co., Toledo, Ohio—Robert G. Sevrence, secretary and treasurer.

Stanley Works, New Britain, Conn.—Donld W. Davis, director.

General Cable Corp., New York, N. Y.—D. M. Fuge, general manager of sales and merchandising.

Dow Corning Corp., Midland, Mich.—Shailer L. Bass, president and chief executive officer; succeeding W. R. Collings, honorary chairman of the board; John L. Hanigan, executive vice president and director.

Pace Electrical Instruments Co., Inc., Glendale, L. I., N. Y.—Floyd I. Makstein, sales manager.

Continental Electric Equipment Co., Ludlow, Ky.—Anson C. Fyler, executive vice president; Electrical Div.

Hycon Mfg. Co., Monrovia, Calif. —John C. Barnes, vice president of engineering.

Cutler-Hammer Inc., Milwaukee, Wis.—James L. McDowell, manager of systems and procedure.

Moloney Electric Co., St. Louis, Mo.—George Dunfield, executive vice president; M. B. Mallet, manager of Transformer Div.

Jefferson Electric Co., Bellwood, Ill.—William G. Lynch, manager of new product line development department.

Westinghouse Electric Corp., Pittsburgh, Pa.—John W. Stirling, vice president; W. J. Delaney, Jr., general manager, Standard Control Div., Beaver, Pa.; R. Wayne McLaughlin, general manager, Air Conditioning Div: Charles E. Erb, marketing manager, Major Appliance Div., Columbus, Ohio.

Regional Appointments

NEW ENGLAND

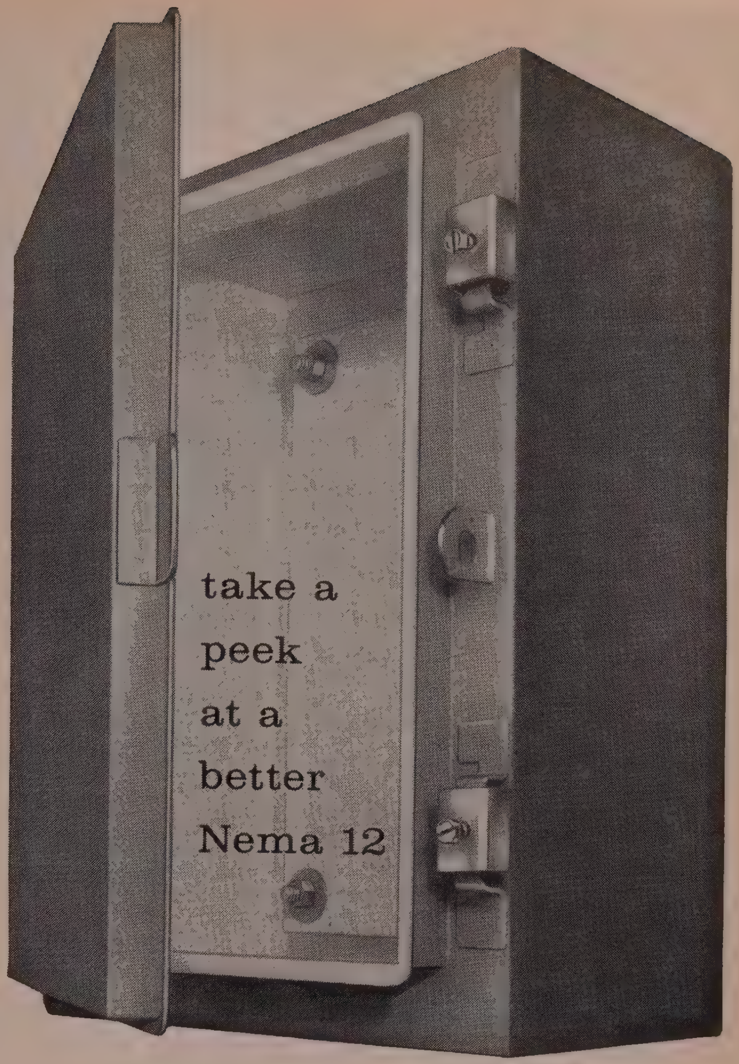
Sylvania Electric Products Inc.: John T. Conley, Jr., manager of Waldoboro, Me., plant; Lighting Products Div.

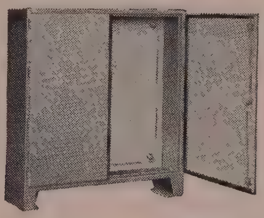
Rockbestos Wire & Cable Co.: John D. O'Brien, New England district sales manager with headquarters in Boston.

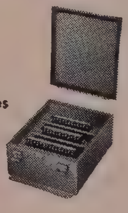
Tann Controls Co.: North Coast Sales Co., Inc., Needham Heights, Mass. factory representative in New England states.

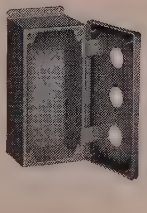
Balteau Electric Corp.: Frank C. Guise, sales manager, eastern division, headquartered in Stamford.

Pace Electrical Instruments Co., Inc.: Manu-Rep, Inc., Needham Heights, Mass., sales representatives throughout Connecticut, Maine, Massachusetts, Rhode Island and Vermont.









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Pushbutton Enclosures

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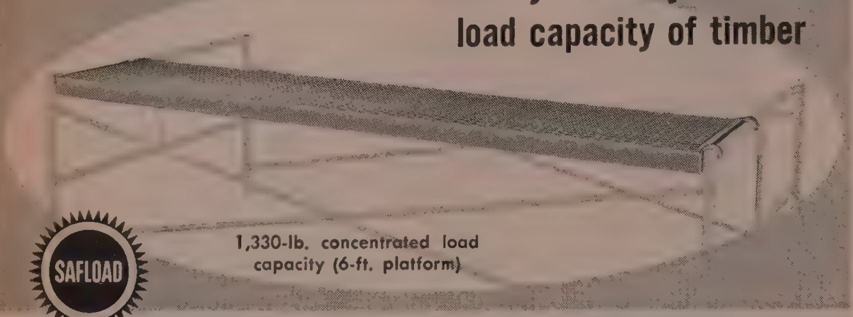

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Span	Concentrated load — lbs.		Uniform load — lbs./lin. ft.	
	Planks*	Safload**	Planks*	Safload**
10′	427	800	95	160
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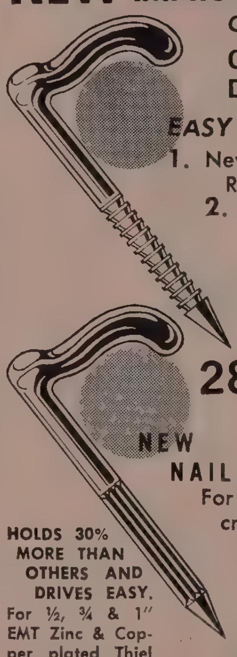

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For Green Concrete and Mortar Joints. Saves Unnecessary Drilling and Expansion Shells.

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Electronic Specialty Co.: Henry Geist & Associates, Stamford, Conn., sales representatives in New England and New York area.

MIDDLE ATLANTIC

Litecraft Mfg. Corp.: George Goodman, district sales manager for metropolitan New York area.

Hevi-Duty Electric Div., Basic Products Corp.: Arthur E. Peabody, Albany, sales representative in New York state covering eastern portion exclusive of metropolitan New York City area.

Gould-National Batteries, Inc.: Andrew G. Howard, regional sales manager for Pittsburgh area; K. A. Vaughan, central marketing manager in the Atlantic, Southern, Gulf and St. Louis regions; Industrial Battery Div.

Tann Controls Co.: Sunday-O'Brien, Haddonfield, N. J., factory representative for New Jersey, Delaware and eastern Pennsylvania.

Cutler-Hammer Inc.: Charles J. Kustner, branch manager of York, Pa., sales office.

Carol Cable Co.: Max Stoff, Pittsburgh, representative in the western Pennsylvania area.

Furnas Electric Co.: Al F. Zissler, sales representative at Rochester, N. Y. with branch offices at Buffalo and Syracuse.

Carpenter Steel Co.: Anthony A. Mendes, district manager in the North Jersey area.

Indiana General Corp.: Edward W. Stone Associates, Montclair, N. J., northeastern sales representative covering southeastern New York state, southern Connecticut and northern New Jersey; Magnetic Equipment Div.

SOUTH ATLANTIC

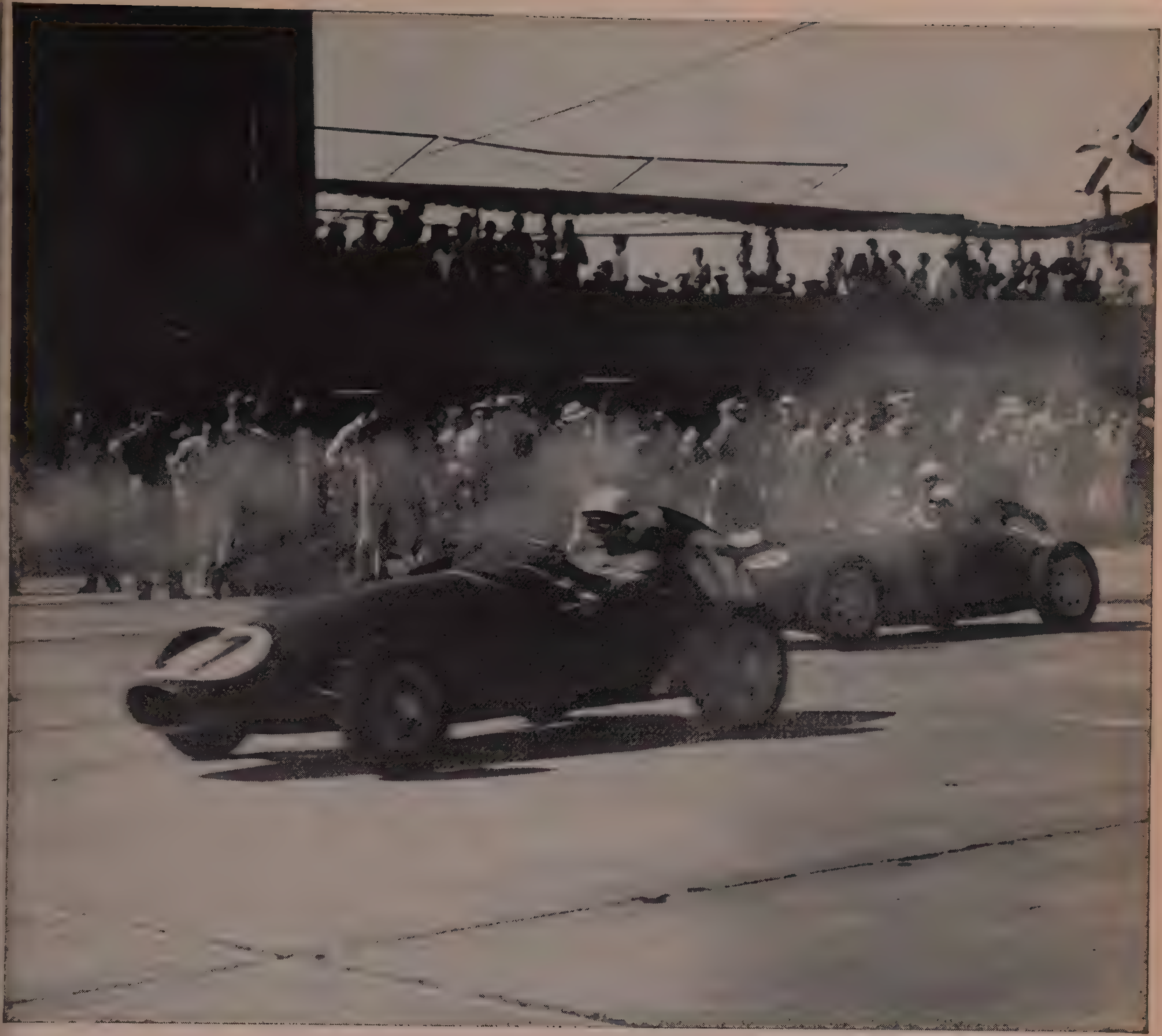
Hevi-Duty Electric Div., Basic Products Corp.: John S. Clayton, Richmond, Va., representative for eastern Virginia; Glenn and Larson of Carolina, Inc., Charlotte, N. C., representative in North Carolina, northwestern South Carolina and bordering sections of Tennessee; G. C. Weldon, Coral Gables, representative in Florida.

Trent, Inc.: H. C. R. Folmer, Ft. Lauderdale, representative in Florida; George Crossley & Associates, Atlanta, representative in Georgia, Alabama and east Tennessee areas.

EAST CENTRAL

Hevi-Duty Electric Div., Basic Products Corp.: Ernie L. Lester, Indianapolis, sales representative in Indiana.

I-T-E Circuit Breaker Co.: Ed-



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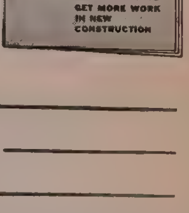

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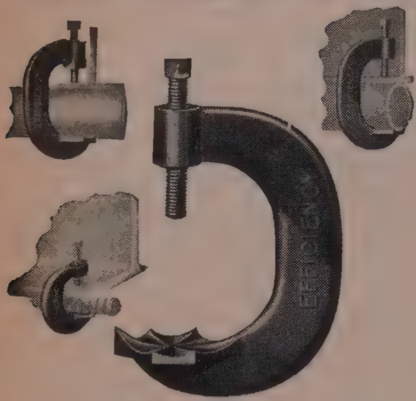
SUBCONTRACTORS
GET MORE WORK
IN NEW
CONSTRUCTION

EFFICIENCY
CONDUIT HANGERS·
for GAS · CABLE
and AIR LINES



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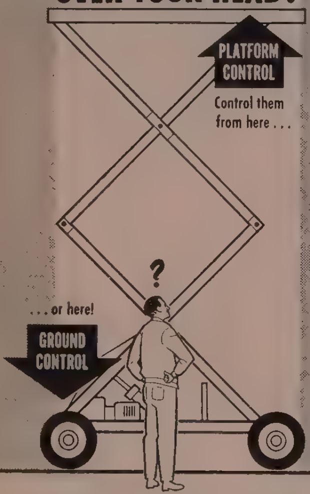

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ELECTRICAL ENGINEERS were well represented in Commercial-Industrial Applied Lighting Competition at IES South Pacific regional conference when Robert Chum, Emil Holuberb & Associates, Southern California Section (left); Carl Long, Diablo Section, (2d from L) and Bruce Thyberg, San Diego Section, (extreme right), met James Hicks, Arrowhead Section; Milton Very, Golden Gate and Jack Todd, San Jose, in regional finals at San Diego. Top awards went to Hicks, Thyberg and Long, in that order.

ward E. Dymek, manager of Memphis district office.

U. S. Steel Corp.: R. P. Moffett, manager of new southeastern area electrical sales office in Birmingham, Ala., Wire Div.

Tomic Sales & Engineering Co.: Riecher Electric Sales, Detroit, Mich., sales representative for the state of Michigan.

Indiana General Corp.: H. M. Rankin, sales representative for Michigan with headquarters in Clarkston; Magnetic Equipment Div.

General Electric Co.: Thomas J. Coffey, sales representative for Silicone Products Dept. with offices in Cleveland.

Multi-Amp Electronic Corp.: A. L. Crichton, midwest district manager, covering Chicago-Milwaukee Lake Shore area and the northern portion of Indiana, together with Michigan, Ohio and western Pennsylvania.

Youngstown Sheet and Tube Co.: Rodney V. Nilsson, Chicago district sales manager.

Sola Electric Co.: Donald C. Zalesky, sales engineer for Chicago district.

Oak Mfg. Co.: Verner L. Howell, Sr., midwest regional sales manager, covering Illinois, Indiana, Iowa, Wisconsin, Michigan, Ohio, Missouri, Kansas, and Kentucky.

National Lock Co.: George Kennedy, Chicago field representative, Industrial Sales Div.

Brush Instruments, Div. of Clevite Corp.: Robert J. Jones, manager of new Detroit district office covering Michigan and northwestern Ohio.

WEST CENTRAL

Hitemp Wires Co.: T. J. Ray Co., Tulsa, Okla., sales representatives.

Indiana General Corp.: Jasper Engineering and Equipment Co., Hibbing, Minn., sales representative; R. C. Brown, Dallas and Houston, Texas, sales representatives; Magnetic Equipment Div.

U. S. Steel Corp.: U. D. Burk, manager of new Houston electrical sales office; Wire Div.

General Electric Co.: Richard M. Wall, sales representative for Silicone Products Dept. in northern Texas and Oklahoma with offices in Dallas.

Carpenter Steel Co.: M. L. Duggins, district manager in St. Louis, Mo.

WEST

General Electric Co.: Milan E. Groby, manager of new sales office in Seattle, Wash., Silicone Products Dept., covering Oregon, Washington, Montana and Idaho.

Hitemp Wires Co.: Walter A. Earle, west coast sales manager based in Monrovia, Calif.

Tann Controls Co.: Huntington Engineering Co., Pacific Palisades, Calif., factory representative serving California and Arizona.

Barkelew Electric Mfg. Co.: Charles W. Denny, III, western regional sales manager based at San Francisco covering sales operations west of the Mississippi River.

Jefferson Electric Co.: Jarald D. Huggins, western sales manager, located in Los Angeles.

Hubbard and Co.: Jerome E. Boyer, district sales manager covering Oregon and Washington and part of Montana with offices at Portland; West Coast Div.

National Lock Co.: David Bowers, Portland, Ore., field representative, Industrial Sales Div.

KNOW CIRCUIT X/R RATIO

[FROM PAGE 107]

Assume:

$I_{rms1} = I_{rms2}$

From previous data on ratio of I_{rms}/I_{ac}:

$I_{rms1} = 1.33 \times I_{ac1}$

$I_{rms2} = k \times I_{ac2}$ where,

k = factor given previously for ratio of I_{rms}/I_{ac} for some value of X/R greater than 6.6

Then,

$$1.33 \times I_{ac1} = k \times I_{ac2}$$

$$I_{ac2} = \frac{1.33}{k} \times I_{ac1}$$

I_{ac2} = the reduced symmetrical rating of the breaker when used at the $X/R > 6.6$

Rating factors for different X/R ratios are as follows:

X/R	*Rating Factor* (%)
6.6	100
11.72	90.5
15.00	87.5
20.00	84.6
25.00	83.0
100.00	77.0

It is suggested that where one of the following four conditions exists—local generation, dry-type transformers above 750 kva, conventional high-impedance transformers or current-limiting busways and reactors, and the calculated system available short-circuit current is greater than 85% of the rated short-circuit current of the breaker—either of the following procedures should be undertaken:

1. A complete study of the system and the resulting multiplying factors considered in the determination of the system properties and the selection of the proper circuit breaker.
2. A simpler approach would be to multiply the calculated symmetrical short-circuit current by 1.15. This product would then determine the short-circuit rating of the circuit breaker for most applications.

ATTENDING the NECA Convention in Minneapolis, Minn., were W. O. Lepore, Bell Electric Co., Inc., Providence, R. I.; G. A. Bishop, Crawford Electrical Co., Fall River, Mass.; and C. E. McKenna, Chapter Manager, Providence, R.I.

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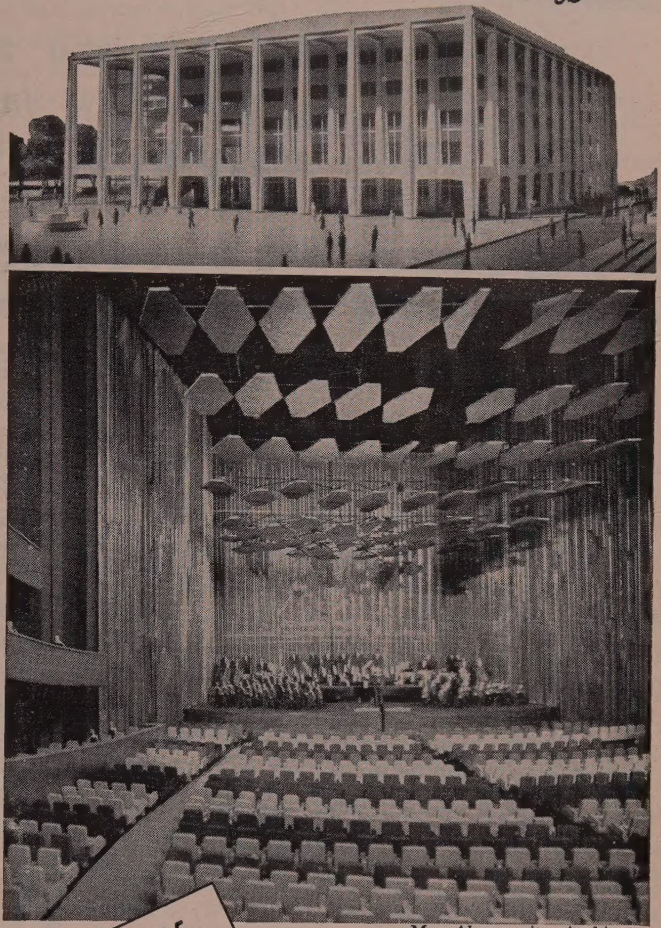

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(My commission expires March 30, 1963)

HOSPITAL EMERGENCY POWER

[FROM PAGE 110]

Investigating this problem showed that in a power failure, the small 25-kw unit would start and run immediately, while the big unit would wait for the time delay required by the utility company. When it started, air would get into the fuel line somehow and kill the big unit. The addition of a day tank and pump finally did the trick by keeping a positive head of fuel oil on both unit's fuel pumps.

Recently a new wing was added to the existing building which almost doubled the hospital's bed capacity. Two new operating rooms were added with auxiliary spaces along with a considerable bit of specialized equipment used in heart surgery.

The service was relocated, enlarged, and converted to wye (Fig. 4). The generator neutral was then reconnected and the equipment used as originally delivered.

The only items not re-used from the original emergency power installation were the neutral transformer, and the high-leg bucking transformer and tap changing switch. The little 25-kw generator was disconnected as its single phase output could not be used to feed the circuits now converted to 3-phase 4-wire. Of the total installation, the value of equipment wasted amounted to less than the depreciation accumulated during the time the emergency generator had been in use.

Adequate and economical planning in selecting the size of the generator can be shown as follows. Overload relays had been installed and set at 277 amps, 80% of the maximum generator output. When tripped, an alarm sounded indicating a high load. Three years after the work was completed, this alarm rang for the first time. Shortly thereafter, the new wing mentioned previously was built, and the hospital's electrical load was reconnected and balanced on all phases. The high leg, which had been lightly loaded and represented one third of the generator's capacity, made available 50% more emergency power for use now, than under the previous operating conditions. Long-range planning has paid-off.

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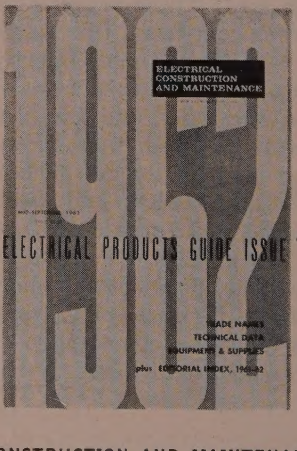
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